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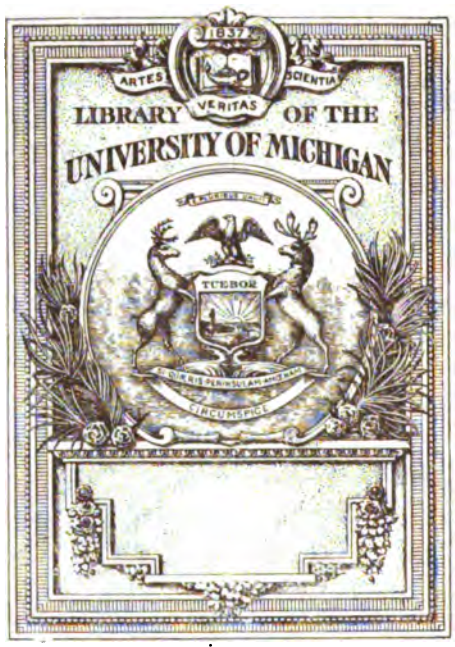

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PUBLIC DOCUMENTS

OF THE

STATE OF CONNECTICUT

VOL. IV—PART II

1918

PRINTED AND BOUND IN COMPLIANCE WITH STATUTE

HARTFORD

1919

NOTE.

Commencing with the documents for the year 1900, a Document Number was assigned to each State departmental report.

This number was determined by the chronological order of the first printed independent issue of such report and will in future be retained by it, thus showing the relative chronological place it occupies in the printed reports of the State.

A list of these reports, with the date of first printed issue and the document number of each, appears on the following page.

CHRONOLOGICAL ORDER OF FIRST PRINTED REPORTS OF DEPARTMENTS.

Document Number.		
1.	Comptroller,	1807
2.	School Fund (since 1909 in Treasurer's report),	1809
3.	Governor's Message,	1817
4.	State Prison,	1828
5.	Bank Commissioner,	1838
6.	Adjutant-General,	1838
7.	Quartermaster-General,	1839
8.	Board of Education (first issued by Commissioner of Common Schools),	1839
9.	Vital Statistics (first issued by Secretary of State),	1847
10.	Treasurer,	1852
11.	Connecticut School for Boys (Reform School),	1853
13.	State Librarian,	1855
14.	County Commissioners,	1862
15.	Connecticut School for Imbeciles,	1862
16.	Manual and Roll (since 1907 in Register and Manual and Pocket Manual only),	1864
17.	Insurance Commissioner,	1866
18.	State Board of Agriculture,	1866
19.	Fish and Game Commissioners,	1867
20.	Connecticut Hospital for the Insane,	1867
21.	Connecticut Industrial School for Girls,	1870
22.	Indebtedness, rate of tax, etc. (Quadrennial)	1874
23.	Bureau of Labor Statistics,	1874
24.	Connecticut Agricultural Experiment Station,	1878
25.	State Board of Health,	1879
26.	Statement of Vote for State Officers,	1880
27.	Criminal Business of the Courts,	1880
28.	State Board of Charities,	1882
29.	Connecticut (formerly Storrs) Agricultural College,	1882
30.	Shell-Fish Commissioners,	1882
31.	Estimate of State Expenditures,	1885
32.	Dairy and Food Commissioner,	1887
33.	Factory Inspector,	1887
34.	Storrs Agricultural Experiment Station,	1889
35.	Board of Education of the Blind,	1895
36.	Highway Commissioner,	1897
38.	Commissioner on Domestic Animals,	1898
40.	Attorney-General,	1900
41.	Examiner of Public Records (formerly Commissioner of Public Records),	1900
42.	Dental Commission,	1901
43.	Israel Putnam Memorial Camp Ground Commission,	1902
44.	Connecticut Prison Association *de* Probation Law,	1904
45.	State Police Department,	1904
46.	Mediation and Arbitration, Board of,	1901
47.	Geological and Natural History Survey,	1903
48.	Tax Commissioner,	1903
49.	Soldiers' Hospital Board (last report 1908),	1905
50.	Board of Control,	1906
51.	Norwich State Hospital for the Insane,	1906
52.	Quadrennial Statement of Property exempt from Taxation,	1910
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54.	Connecticut Reformatory,	1910
56.	Public Utilities Commission,	1911
57.	Rivers, Harbors, and Bridges Commission,	1912
58.	Workmen's Compensation Commission,	1914
59.	Civil Service Commission,	1914
60.	State Park Commission,	1914
61.	Public Library Committee (formerly with Bd. Edu.),	1914
62.	Agricultural Extension Service,	1916
63.	State Board of Finance,	1916
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65.	Mansfield State Training School and Hospital,	1918
66.	Commission on Uniform Legislation,	1918
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PUBLICATION
APPROVED BY
THE BOARD OF CONTROL

LETTER OF TRANSMITTAL

To His Excellency, Marcus H. Holcomb, Governor of the State of Connecticut:

I have the honor to submit herewith the report of the board of trustees of the Connecticut Agricultural College for the two fiscal years ended September 30, 1918, and for the two years in other matters ended November 30, 1918.

Very respectfully,

OLCOTT F. KING,

Secretary of the Board of Trustees.

THE CONNECTICUT AGRICULTURAL COLLEGE

BOARD OF TRUSTEES

The Governor of Connecticut ..... Ex-officio

MARCUS H. HOLCOMB, Southington

Appointed by the Senate	Term Expires
E. STEVENS HENRY, Rockville	1919
CHARLES E. LYMAN, Middlefield	1919
IVERSON C. FANTON, Westport	1919
CHARLES M. JARVIS, Berlin	1921
JOSEPH W. ALSOP, Avon	1921
E. KENT HUBBARD, Middletown	1921

Elected by the Alumni

OLCOTT F. KING, South Windsor	1919
HARRY G. MANCHESTER, Winsted	1921

Elected by the Board of Agriculture

EVERETT E. BROWN, Pomfret Center	1921

Officers of the Board

GOVERNOR MARCUS H. HOLCOMB ..... President
HARRY G. MANCHESTER ..... Vice-President
OLCOTT F. KING ..... Secretary
RAYMOND I. LONGLEY ..... Treasurer

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J. W. ALSOP, C. M. JARVIS, H. G. MANCHESTER, I. C. FANTON

Experiment Station Committee

C. M. JARVIS, E. S. HENRY, EVERETT E. BROWN

Extension Committee

O. F. KING, C. E. LYMAN, EVERETT E. BROWN

Administration Committee

H. G. MANCHESTER, O. F. KING, E. K. HUBBARD

CONNECTICUT AGRICULTURAL COLLEGE

HISTORICAL SKETCH

Storrs Agricultural School was established by an Act of the General Assembly in January, 1881. The State at this time accepted the gift of a farm and $5,000 in money from Charles and Augustus Storrs. An appropriation of $5,000 was made for the maintenance of the institution. The object of the School, as stated in the Act establishing it, was "the education of the boys whose parents are citizens of this State in such branches of scientific knowledge as shall tend to increase their proficiency in the business of agriculture." The name was subsequently changed to Storrs Agricultural College and later to the Connecticut Agricultural College. The Board of Trustees admitted young women, providing for them education in such branches of knowledge as tend to increase proficiency in the art of housekeeping and homemaking.

As a college, the institution fell heir to the federal income from the Land-Grant Act of 1862 and the Morrill Act of 1890 and became responsible for half the Experimental Station work in the state, for which annual provision had been made by the Hatch Act of 1887. In July, 1914, the college became the recipient of the federal appropriation for Extension work.

In the acceptance of Federal support, the state is under moral and legal obligations to maintain the scope of education appropriate to land-grant colleges.

SUPPORT OF THE COLLEGE

From the State the Trustees receive for the college proper, $52,500 for the Storrs Experiment Station, $7,500, and for Extension work, $15,000 annually. From the National government it now has the following fixed annual income: under the Land-Grant Act, $6,750; under the Morrill and Nelson Acts, $50,000; under the Hatch and Adams Acts, providing for Agricultural Experiment Stations, $15,000, and under the Smith-Lever Act, approximately $15,000 for Extension work. The use of federal funds is limited to certain specified objects—none of the first two amounts and only a small percentage of the last two amounts can be used for construction and repair of buildings or for the purchase of land.

The State is required to cooperate by providing a suitable home for the college. Accordingly, from time to time, special appropriations have been made for the purchase of land and for the erection of buildings.

From the federal funds are paid practically all the salaries of instruction and administration. The annual income regularly received from the State is devoted to the support and improvement of the college plant as a whole.

SYSTEM OF CONTROL

The control of the institution is vested in a Board of Trustees consisting of ten members, including the Governor,—six appointed by the Senate* for periods of four years each, two elected by the alumni of the college for four years each, and one elected annually by the Board of Agriculture. The Governor is ex-officio president of the Board. The Trustees elect their own officers with the exception of their president. They also elect the college officers.

ACTIVITIES OF THE INSTITUTION

EXPERIMENT STATION:—The Experiment Station is a research department of the college. It is supported, however, by separate and distinct funds. The principal lines of investigation at the Storrs Station are in Dairy Husbandry, Poultry Husbandry, Horticulture, Dairy and Soil Bacteriology.

EXTENSION DEPARTMENT:—Agricultural Extension is an activity that aims to extend to the farmer the results of scientific research and experiments. The farmer cannot come to the College but information can be taken to him. The Federal Government and the several States have expended large sums of money in developing knowledge relating to agriculture. It is the function of the Extension Division through its leaders and experts and in cooperation with the Farm Bureaus to disseminate in the various communities of the State to persons not attending the Agricultural College the latest scientific knowledge relating to Agriculture and Home Economics.

COLLEGE:—The function of the College is to train young people for leadership in country life. The College offers to resident students, courses in agriculture designed to train young men as farmers, teachers, investigators and agricultural experts. Courses are offered in Home Economics designed to train young women in science and the art of household management for use in home making and as teachers.

LAND, BUILDINGS AND EQUIPMENT

COLLEGE LAND:—The lands owned by the college comprise about 1339 acres, of which 164 acres are tillable, 22 acres are orchard land, 491 acres are pasture land, 555 acres are wood land, and 107 acres are campus or reserved for buildings. The tillage and orchard land is apportioned to the farm, horticultural department and Experiment Station, and is manipulated in such manner as to illustrate the principles and processes of both general and specialized agriculture, including crop rotation, vegetable production and fruit growing. The campus and wooded reservations furnish good facilities for scientific instruction in landscape gardening, floriculture, road making, and forestry.

BUILDINGS:—The College comprises 73 main buildings, including Administration Building, Horticultural Hall and Greenhouses, Armory and Auditorium, two dormitories for young men, two dormitories for young women, Dairy Building, Dining Hall, Poultry Building, Whitney Hall, Central Heating Plant, 34 Dwelling Houses, 16 Barns and Store Houses, 4 Garages and 5 other small buildings.

WATER AND SEWAGE SYSTEMS:—Water from two bored wells, 300 and 1100 feet in depth is supplied to all buildings. The sewage is purified on sand filters, eight in number, each 20 feet by 30 feet in size and four feet deep. The beds are used in rotation. The effluent is practically odorless and non-putrescible.

*Beginning July 1, 1919, appointment of Trustees to be made by the Governor instead of the Senate.

INVENTORY OF LAND, BUILDINGS AND EQUIPMENT.

Land 1339 Acres	$ 63,315.00
Dormitories (4)	230,075.00
Armory and Auditorium	90,400.00
Horticultural Building	34,400.00
Main Building	35,366.00
Dining Hall	26,000.00
Dairy Building	34,975.00
Poultry Building	34,400.00
Machinery Building	18,976.00
Dwelling Houses (34)	224,499.00
Barns, Storehouses, etc. (16)	69,675.00
Garages (4)	1,700.00
Greenhouses	32,000.00
Other Buildings	20,100.00
Water and Sewage Systems	50,000.00
Central Heating Plant	77,378.00
Live Stock	34,554.00
Apparatus, Machinery & Furniture	148,642.00
Gilbert Farm	65,000.00
Gilbert Farm Endowment	120,000.00
	$1,411,455.00

REPORT OF THE PRESIDENT

FOR THE TWO YEARS ENDED NOVEMBER 1, 1918.

BOARD OF TRUSTEES:—The Senate in 1915 appointed Joseph W. Alsop, Charles E. Lyman and E. Kent Hubbard as trustees for a period of four years; The Board of Agriculture in 1917 and again in 1918 elected Everett E. Brown for a period of one year; The Alumni in June 1917 elected Harry G. Manchester for a period of four years.

RESIGNATIONS FROM COLLEGE STAFF:—Daniel Chase, Professor of Physical Education; Ethel T. Cousley, Instructor in Home Economics, September, 1916; Miriam A. Thompson, Instructor in Music, August, 1917; Margaret Costello, Instructor in Home Economics, October, 1917; Lieutenant Charles B. Amory, Professor of Military Science, November, 1917; Colonel John S. Parke, Professor of Military Science; Benjamin G. Southwick, Assistant Professor of Agronomy; Henry F. Judkins, Instructor in Dairy Husbandry, May, 1918; Floyd W. Duffee, Instructor in Agronomy; Corinne R. Tapley, Instructor in Home Economics, June, 1918; Stella M. Findlay, Manager of Boarding Club, August, 1918;

MEMBERS OF COLLEGE STAFF IN MILITARY SERVICE:—George S. Torrey, Instructor in Botany; Glenn H. Campbell, Instructor in Dairy Husbandry, Anna M. Wallace, Instructor in English; John A. Kuelling, Instructor in Dairying; Helen Bishop, Instructor in Home Economics; Max F. Abel, Instructor in Agronomy; Harry B. Alger, Instructor in Dairy Husbandry; Henry D. Munroe, Poultry Department; Hugh B. Price, Instructor in Agricultural Economics; Frank P. Miller, Foreman of Farm.

APPOINTMENTS TO COLLEGE STAFF:—M. Estella Sprague, Professor of Home Economics, November, 1917; George W. Fraser, Instructor in Floriculture, September, 1916; Corinne R. Tapley, Instructor in Home Economics; Helen Bishop, Instructor in Home Economics, October, 1916; Hugh B. Price, Instructor in Agricultural Economics, July, 1917; Max F. Abel, Instructor in Agronomy, September, 1917; John A. Kuelling Instructor in Dairy Husbandry; Arthur G. Skinner, Instructor in Animal Husbandry; Herbert M. Hays, Instructor in English, November, 1917; Colonel John S. Parke, Professor of Military Science; Ben. C. Helmick, Instructor in Agronomy, April, 1918; Ella J. Rose, Instructor in Home Economics, June, 1918; Lloyd R. Watson, Instructor in Apiculture August, 1918; Edith Mason, Instructor in Home Economics; Helen B. Barker, Instructor in Home Economics; Lt. Col. William F. Flynn, Professor of Military Science; Captain Harry Nesbitt, Instructor in Military Science; Lieutenant William Arner, Instructor in Military Science; Lieutenant Douglas E. Brown, Instructor in Military Science; Lieutenant Herbert R. Brown, Instructor in Military Science; Lieutenant Leonard T. Brown, In-

structor in Military Science; Lieutenant Raymond Goodale, Instructor in Military Science, September, 1918; Arsene Croteau, Instructor in French; Pierre Gault, Instructor in French; Marshal Dawson, Instructor in History, October, 1918.

The College suffered a serious loss in the death of Alfred Gurdon Gulley who died August 16th, 1917. Mr. Gulley had served the Institution as Professor of Horticulture for twenty-three years. During the greater part of this time, he was in charge of the grounds and the ornamental plantings on the campus and the laying out of walks and drives were the results of his plans. Professor Gulley was loved and respected by the faculty and students alike and during this period of a generation his life and character were an inspiration and example to the students with whom he came in contact and his judgment and council had much influence in shaping the development of the institution during its formative period.

Professor Gulley was a recognized authority on fruit growing and had made a special study of varieties of apples. The following resolution was adopted by the Board of Trustees:—

> "Alfred Gurdon Gulley, a lover of fruits, flowers and trees, and inspiring teacher, loyal to the institution which he served as Professor of Horticulture for a period of twenty-three years, died August Sixteen, 1917.
>
> "The Board of Trustees of the Connecticut Agricultural College herein gratefully record their appreciation of his ability, fidelity and untiring labor for the College and for the advancement of horticulture in the State."

ACTIVITIES OF THE COLLEGE DURING THE WAR

Shortly after the Declaration of War by Congress, the Trustees offered to the State Food Committee and later to the Connecticut State Council of Defense and to the State Federal Food Administrator, the services of the faculty and the resources of the Institution for the duration of the War. (1) In the summer of 1917, Short Courses in Home Economics were offered at the College under the supervision of the Extension Division and instruction given in canning and food conservation. The schools were attended by twenty men and more that five hundred women. (2) During the summer of 1918, the College gave instruction in agriculture to members of the Boys' Working Reserve. Three camps were held at Storrs, with a total enrollment of two hundred, the boys occupying the College dormitories and boarding at the Dining Hall. After a two weeks period of training, they were assigned to farms and supervised by Mr. Arthur Howe, Director of the Boys' Working Reserve. (3) In the fall of 1918, the Trustees entered into a contract with the War Department to train a unit of four hundred men who were prospective candidates for Commissioned and Non-commissioned Officers' Training Schools. (4)

The activities of the Extension Divison were enlarged and extended, several members of the staff were assigned to the office of the State Food Committee and the Federal Food Administrator and were helpful in organizing and conducting the campaigns for stimulating increased food production and conservation. The detailed activities of the Extension Division as reported by the Director may be found on pages ——.

STUDENTS' ARMY TRAINING CORPS

Under the authority of the act of Congress authorizing the President to increase temporarily the military establishment of the United States, the War Department organized a Students' Army Training Corps and made contracts with several hundred Colleges to receive registrants under the Selective Service regulations who satisfied their entrance requirements and who upon physical examination were found fit to perform full or limited military duty. Under the contracts, the War Department assumed the cost of quartering, subsistence and instruction of the student-soldiers. The quota agreed upon for the Connecticut Agricultural College was a unit of 400 men.

The purpose of the Students' Army Training Corps is to utilize effectively the plant equipment and organization of the College for selecting and training officer-candidates, technical experts and administrators of every kind. Upon admission to the Unit, the registrant becomes a soldier of the United States. As such, he is subject to military law and military discipline at all times.

From time to time, in accordance with the needs of the service and the qualifications of the individual, the War Department announces that it will be the policy of the Government to assign members of the Students' Army Training Corps to:

(a) An officers training camp or
(b) A non-commissioned officers training school, or
(c) A depot brigade, or
(d) To continue in certain cases such training as the needs of the service may require.

The academic year has been divided into terms of three months each. Students who are 20 years of age are to receive three months training; those who are 19 years of age, a six months training; those who are 18 years of age, nine months training. The instruction will be partly military, and partly in allied subjects that have a value as a means of training officers and experts to meet the needs of the service.

The Committee on Education and Special Training acting for the War Department has approved of the following course of study embracing eleven hours per week of practical and theoretical military instruction and forty-two hours per week including recitations, lectures, laboratory instruction allied subjects and the necessary time of preparation. The following course of study has been approved:

Total Hours of Instruction

Subjects	20 yrs. of age	19 yrs. of age	18 yrs. of age
Military Instruction	132	264	396
War Issues & English	108	216	324
Military Law	108	108	108
Sanitation & Hygiene	108	144	144
Surveying & Mapmaking	144	144	144
Assigned reinforcement study	366		
Meteorology		108	108
French, German or Chemistry		288	288
Descriptive Geometry & Drawing			144
Geography of Europe			108
Trigonometry & Logarithms			144
Total	636	1272	1908

The student-soldiers are quartered in the dormitories. The problem of messing the increased numbers of students has been solved by the adoption of the cafeteria system of serving at the Dining Hall. The instruction in allied subjects is being given by the members of the faculty with the exception of the courses in Military French and Courses in Issues of the War. The six fraternities have suspended their activities for the time being and have leased their club rooms to the War Work Council of the Y. M. C. A.

As the result of wide publicity of the provisions of the Students' Army Training Corps, more than 500 applications were received for admission to College. Those making application after our quota of 400 had been filled were advised to enter other institutions. The students were called for physical examination and induction into the S. A. T. C. on September 24 to 28. On their arrival at Storrs, it developed, that the Contract Surgeon, Dr. Simonds, who had been detailed to make the physical examinations was ill with influenza and the young men were given the choice of remaining and enlisting for military training in a volunteer company or of returning home to report at a later date. 55 elected to remain and were formed into a company and given military drill. Owing to the prevalence of influenza, the second call to report for physical examination on October 8 was cancelled on the advise of Dr. Black, the State Health Commissioner. The third call to report for physical examination was issued for October 21 to 24. Owing to the delay in opening, a number who had made application for admission to the Connecticut Agricultural College entered other institutions. The total number entering College was 411. Of this number 37 were rejected on physical examination, 25 under eighteen years of age were accepted for enrollment, 288 were accepted and inducted, and 61 were accepted but owing to the delay of local boards, failed of induction and were discharged as

civilians by the order of the President suspending induction on November 11.

The cessation of hostilities and the signing of the armistice has resulted in a cancellation of the contract with the War Department and the issuance of an order to demobilize the Students' Army Training Corps and discharge the soldiers not later than December 21.

The operation of the S. A. T. C. was well conceived and if the War had continued the fundamental purpose of the Government in developing a body of young men capable of leadership as commissioned officers would have been realized. Until the armistice was declared the students took a keen interest in both military and academic training. The physical conditions and health of students were improved and there were no questions of absences or discipline for the Faculty to deal with. The simple and decorous forms of military courtesy adopted and made use of by the student-soldiers were noticeable and pleasing. The waste of time formerly common in connection with athletics, social events, dormitory life and fraternities disappeared and as a result, the students approached nearer 100% efficiency in the use of their time than under normal conditions.

The College will resume the regular course of instruction beginning December 30. Two terms of instruction of twelve weeks each, have been scheduled to supercede the two-semester work as scheduled in the catalog for 1917-1918. Academic credit will be given those students who satisfactorily completed the first term of the course prescribed for the S. A. T. C.

Application has been made for the re-establishment of the Reserve Officers' Training Corps. Notice has been received that the application has been granted and that an Officer will be detailed to serve as Commandant and Professor of Military Science.

STUDENTS IN MILITARY SERVICE:—Colleges everywhere are breeding-places of patriotism and loyalty. College students excel in ambition, initiative, resources, and possess the qualities of leadership and devotion to service which are the necessary qualities for officers and administrators in Military affairs. Colleges have furnished their full quota of men in all branches of the service. The Secretary of the Alumni Association is collecting the military records of the graduates and former students of the Connecticut Agricultural College and the information will be published later when the records are complete. More than 500 Storrs men are known to be in Military Service. Many of them are over-seas, several have been wounded and five have made the supreme sacrifice. The sympathy of teachers and students goes out to friends and families who mourn the loss of their devoted and patriotic young men. There is some consolation in recording that they have died for their country. While the college mourns the loss of its sons, it is proud of them and will always hold in sacred memory, their heroism and sacrifice. It will be our duty to

perpetuate their life and death by some suitable memorial on the Campus.

NEW BUILDINGS AND IMPROVEMENTS:—The legislature of 1917 made an appropriation of $100,000 to the College for buildings and improvements. Plans and specifications were prepared by Unkelbach and Perry and bids were received for the erection of a Dining Hall, Infirmary and four Faculty Cottages. Before letting the contracts the Trustees consulted the State Council of Defense regarding the advisability of undertaking construction and on their recommendation, the Board decided to defer all building operations with the exception of one cottage until after the close of the War. Several houses located near the campus were purchased on advantageous terms, also the Rosebrooks Farm. One cottage was erected and an exchange made for other property with Mrs. M. B. Whitney. The appropriation of 1917 for buildings and improvements has been expended or contracted for as follows:—

EXPENDITURES FOR 1917

Appropriation for Buildings and Improvements

1.	Purchase of eight dwelling houses including 225 acres of land	$47,773.00
2.	Well and Reservoir	11,634.00
3.	Coal Bunker at Eagleville	9,000.00
4.	Poultry Buildings	9,500.00
5.	Piggery	4,000.00
6.	Central Heating Plant	3,308.00
7.	Three Garages (ten stalls)	1,465.00
8.	Architects plans for Dining Hall	3,775.00
9.	Barn for Dairy Sires	2,963.00
10.	Grading and Walks	2,500.00
11.	Live Stock	2,375.00
12.	Sewage Pump	474.09
13.	Storage Shed, Bacteriology Department	425.00
14.	Other Improvements	808.00
Total		$100,000.00

LOSS OF THE CHEMICAL LABORATORY.

The Chemical Laboratory was destroyed by fire on the night of November 27th, 1917. The building and contents were insured for $13,500. The Chapel room in the Administration building has been remodeled to provide accommodations for laboratory instruction in chemistry and arrangements have been made for the analysis of samples in connection with the research work of the Experiment Station at the laboratory of the Connecticut Agricultural Experiment Station in New Haven.

GIFTS:—The Trustees received from the late Austin C. Dunham, a deed to a farm of 135 acres of land located in the town of Newington. The farm, including buildings, tools and livestock, was valued at $25,000. The only restriction by the donor was that the farm or the money received from the sale of the property should be used for the promotion of the agriculture of the State.

SCHOOL OF HOME ECONOMICS DISCONTINUED:—The policy of a State College should be to connect with the secondary school system of the state but not to duplicate it. Instruction in cooking and sewing is scheduled in a majority of High School courses. It seemed to the Trustees unnecessary, therefore, to continue the instruction in the secondary school of Home Economics. A decision was made to concentrate upon the instruction in College Courses in Home Economics, and to discontinue the School. The first year of the School of Home Economics was omitted in 1917-18 and the second year will be omitted in 1918-19. The same arguments do not apply as yet to the School of Agriculture, a secondary course for boys, in as much as there are but three High Schools offering instruction in Agriculture.

TEACHER TRAINING COURSES:—In accepting the benefits of the Federal Smith-Hughes Act, the Legislature in 1917, designated the Connecticut Agricultural College as the Institution for the training to teachers in Agriculture and Home Economics, and for the supervision of agricultural instruction in High Schools

This arrangement will tend to bring the State College and High Schools of the State into closer relationship and coordination. The graduates of secondary schools who are interested in agriculture and Home Economics will receive encouragement to continue their studies and find it possible to obtain a college training. The College will benefit by the additional funds and the students in the opportunity for wider electives.

STUDENT ENROLLMENT:—The male attendance in regular courses was 161 for the year 1917-18 as compared with 208 for the year preceding. The decrease in attendance is attributed to the draft of students over twenty-one years of age for military service, to voluntary enlistment on the part of those under draft age and to the demand for labor and the attending high wages. The lowering of the draft age to eighteen years, effective September 12, 1918, and the establishment of the Students' Army Training Corps resulted in an enrollment of 411 men students for the Fall Term in 1918.

11 young women were enrolled in the College Course in Home Economics for the year 1916-17 and 25 for the year 1917-18 and 23 for the Fall Term of 1918.

NEEDS OF THE INSTITUTION FOR MAINTENANCE

1. MAINTENANCE OF THE STORRS EXPERIMENT STATION:—The State appropriates $7,500. and the Federal Government appropriates $15,000, annually to the Experiment Station. The Federal Grant was intended to form a nucleus of a fund to be supplemented by equal, if not larger, appropriations from the State. All disseminating agencies, the College, the Extension Department, Institute Boards and Agricultural Associations are dependent upon Experiment Stations for the information which they disseminate. Connecticut should do her share, and it is not to the credit of the State that she draws so large an amount from outside sources. The appropriation for the Storrs Experiment Station should be increased to an amount equal to that contributed by the Federal Government.

2. EXTENSION DIVISION:—As the term implies, agriculture extension is an activity that aims to extend to the farmer the results of scientific research and experiment. The farmer cannot come to the College, but information can be taken to him. The Federal Government and the several states have expended large sums of money in developing scientific knowledge relating to agriculture. The Extension Department is an agency which aims to afford instruction and demonstration in Agriculture and in Home Economics to persons not attending the Agricultural College, by lectures and demonstrations and otherwise in the various communities of the State. An Extension Department has been organized at the College with a director and a staff of assistant specialists in the lines of Dairying, Poultry Husbandry, Home Economics, Marketing, Farm Management, Agronomy, and Boys' and Girls' Club Work. An organization has been formed and a leader appointed in each county of the State. The activities of the Extension Division has been gradually extended by reason of the War. The famine conditions in Europe which must be alleviated by large shipments of food from the United States call for a continued stimulation of crop production and food conservation. The Extension Division should receive liberal offers from the legislature in order that its activities need not be curtailed at this time.

COLLEGE:—The College offers to resident students, instruction in Agriculture designed to train young men as farmers, investigators, teachers and agricultural experts. Parallel courses are offered in Home Economics to young women. The State appropriation to the College is used to pay the salaries of officers of administration, of employees not engaged in instruction, for repairs to building and care of grounds, heating and lighting, insurance, freight and cartage and for the support and improvement of the plant as a whole. The cost of the maintenance of the institution has increased by reason of the advance in wages and the added cost of materials and supplies.

The Trustees have authorized the President to engage, when funds are available, an assistant in Agronomy, a Director of Physical

Education and a Registrar. For the maintenance of the College for the two years beginning October 1, 1919, the expenditures from State funds is estimated at $180,000.

Summary of Needs of the Institution for Maintenance for a Period of Two Years.

Experiment Station	$25,000	
Extension Division	134,300	
College Division	181,220	$340,520

NEEDS OF THE COLLEGE FOR BUILDINGS AND IMPROVEMENTS

1. HOME ECONOMICS:—The State College of Agriculture is co-educational. It is recognized that it is quite as important to train young women for home making as to educate young men for farming. The young woman who is to take her place as the head of a home should have a knowledge of human nutrition, of personal hygiene and home sanitation, of house decoration, and of cooking and sewing.

It may be that our system of agricultural education for men will fail of its purpose until an equal number of young women are trained for home making and country living.

The Connecticut Agricultural College has been designated as the institution for the training of Women in Home Economics and receives the Federal Smith-Hughes funds for this purpose. The enrollment of young Women in the College in the Department of Home Economics was 11 in 1916; 25 in 1917; and 43 in 1918. Grove Cottage, the present girls dormitory has accommodations for 20 students. The overflow of young women is at present quartered in the Valentine House, but even with this outlet there is no room for growth. A Home Economics building is needed with class rooms and laboratories for instruction and to provide dormitory accommodation for 100 young women.

2. DINING HALL:—The Legislature of 1911 granted the Trustees an appropriation for the erection of a building to be used "temporarily" as a Dining Hall. A Mechanic Arts Building was erected. An appropriation is now needed for the erection of a Dining Hall in order that the building now being used for the purpose may be released for instruction in Mechanic Arts.

At present, instruction in wood working and iron work is given in poorly lighted rooms in the basement of the Main Building. Instruction in drafting is given in the attic of the annex to Whitney Hall; instruction in forging in a rented blacksmith shop, and instruction in designing farm buildings in the attic room of the Horticultural Building. The erection of a Dining Hall will release the Mechanic Arts Building and provide facilities for instruction which are so much needed by this department.

3. COTTAGES:—The addition of new members to teaching and extension staffs and the marriage of the younger members of the faculty, make it necessary to provide for additional cottages. No provision having been made by the State for the lease of building sites on the campus. it is necessary for the Trustees to erect a sufficient number of buildings for the members of the teaching, extension and experiment station staffs. The College owns 34 cottages and two apartment houses which are rented and yield a fair return on the investment. There is need at present for four double and four single faculty cottages. Additional cottages are needed for the accommodation of the employees of the institution.

4. FARM IMPROVEMENTS:—The tillable area of the farm could be increased to the extent of about 100 acres by the drainage of the Valentine meadow and swamp near the dairy barn. These fields, easily accessible, free from stone, should be underdrained and made more productive. A small sum should be available also for the removal of walls, for fencing and other improvements. An appropriation is needed for the erection of an ice house and for remodeling the Rosebrooks farm.

5. TEMPORARY CHEMICAL LABORATORY:—Fire destroyed the Chemical Laboratory in November 1917. Temporary but inadequate accommodations were provided by taking over and remodeling the Chapel Room in the administration building for a qualitative laboratory. Additional space is needed for instruction in quanitative chemistry, organic chemistry and for the research work of the Experiment Station. An additional space of approximately 2000 square feet is urgently needed. The cost of an addition to the Chemical Laboratory 30x60 feet in size is estimated at $15,000.

6. POULTRY:—For the purpose of economy, the Experimental Poultry Plant is to be consolidated with that of the College. Additional appropriation is needed to complete the buildings as originally planned.

7. STUDENT INFIRMARY:—The college buildings are located on high ground, with good natural drainage. The water supply is pure, and the sewage system is modern and adequate. While the natural sanitary conditions are excellent, yet when so many congregate, various diseases may be brought by the students themselves. Complaint is made that there is no one to care for students in time of sickness. The charge of $5. per visit by Willimantic physicians is a severe tax on the resources of many with limited means. Nervousness or timidity has been the cause of temporary withdrawal of a considerable number of the student body in the case of the illness of a single fellow student. In February, 1916, the college was closed for four weeks on account of an epidemic of scarlet fever, twelve students contracting the disease. A small infirmary, well equipped with hospital furnishings and medicine, should be provided for the

control of contagious diseases and for the care of other cases of illness or injury.

8. DAIRY BARN:—The herd, composed of representatives of the dairy breeds of cattle, is kept for instruction and experimental purposes. The product of the herd is sold in the form of milk, cream and butter to the boarding club and faculty families. The amount of milk produced, however, is not sufficient to supply the demand, making it necessary to purchase a considerable amount of dairy products during each month of the college year. The Dairy barn should be enlarged, therefore, and the size of the herd increased to at least double the number of milking animals.

9. FORGING SHOP AND EQUIPMENT:—A course in forging is offered to the students of the School of Agriculture and to the students in the College of Mechanic Arts. At the present time the equipment of ten forges with anvils and necessary tools is installed in a leased shop near the campus. The equipment is meager, and the accommodations are insufficient for the number of students registering for this work. It is recommended that a building 62x34 feet, 12 feet high, conforming in style of architecture with the Mechanic Arts Building, be erected near it. The cost of such a structure is estimated at $7,000. and equipment at $3,000.

10. CONCRETE ROAD TO EAGLEVILLE:—The Freight station for the College is Eagleville on the Central Vermont Railroad. About 2500 tons of coal are hauled annually from Eagleville to the College, 1500 tons of miscellaneous freight and 2000 tons of building material at a cost of $1.50 a ton. The distance from Eagleville to the College is 2.8 miles and the difference in elevation is 300 feet. A survey has been made and a layout can be obtained with a maximum grade of 5%. The legislation of 1915 made the road from Storrs to Eagleville an auxillary of the trunk line system of the State. When constructed, this road will furnish an access to the College by automobile by way of the improved roads centering in Willimantic from various parts of the State.

11. WATER SUPPLY:—The Water consumption of the College is from 60,000 to 75,000 gallons per day. The main supply is obtained from a well of five inch bore, drilled through solid rock to a depth of 800 feet. This well yields 50 gallons per minute and is being used to full capacity. A second well, with eight inch bore, was drilled in the summer of 1918 to a depth of 1100 feet. The flow of the well is much below expectations yielding on test 15 gallons per minute. During the past year a dam was constructed about 1000 feet west of the Dining Hall. The water from the reservoir is conducted by gravity to supply the Dairy Building and Dairy and Horse Barns. An additional supply of water is needed. Surface water can be obtained suitable for use at the Power Plant, Greenhouses and for shower baths and for flushing toilets in the dormitories. An appropriation is needed for pipe line pump and storage tank.

12. SEED HOUSE FOR EXPERIMENT STATION:—In the conduct of crop experiments, and the development of pure strains of plants true to type, it is essential that seeds be carried over from season to season through a period of years. The department of agronomy is in need of a house where seeds can be kept dry and secure.

The Whitney Barn should be moved from its present location to the experimental field to be used for the storage of crops and tools.

13. CARPENTER SHOP:—The superintendent of buildings is expected to carry in stock a supply of lumber, hardware and cement, plumbing, painting and electrical supplies used in repairs to buildings, and the maintenance of the plant. A building is needed to house repair and building supplies and to provide accommodations for carpenter, plumbing and paint shops.

14. APIARY:—The College has purchased forty colonies of Italian bees. Mr. Lloyd R. Watson, a specialist in bee culture, has been engaged to give instruction to students at the College and to engage in extension work in a apiculture throughout the State. A building is needed in which equipment for demonstration and instruction in this subjects can be stored and exhibited.

15. ORNAMENTAL PLANTING:—Charles N. Lowrie was engaged in 1910 to prepare a plan for the laying out of the campus with respect to its future growth, taking into account the location and grouping of buildings, laying out of walks and drives, and ornamental planting. By means of a well studied plan, convenience and economy of circulation should be secured. Furthermore, the effect upon students and others of fine surroundings and landscape scenery is of great importance and should have far reaching results where so much of the time is spent in the open air as is at an Agricultural College. Funds should be available each year for the construction of walks and drives and for the ornamental planting of the campus.

16. FRUIT STORAGE AND REFRIGERATION:—A refrigerating room and a packing room for fruit and vegetables are needed as an addition to the equipment of the Horticultural Department. With the crops now harvested there is much waste and loss of fruit due to improper facilities for handling and packing. The cost of a fruit storage building and vegetable cellar and refrigerating room is estimated at $15,000.

17. FIRE PROTECTION:—The value of college buildings and contents is over $850,000. The average rate for insurance is .48 a hundred, which is as low as could be expected under present conditions. The cost to the college for insurance is about $3,500. a year. With adequate facilities for fire protection, there should be a material reduction in the cost of insurance and greater safety for both lives and property.

18. AGRONOMY BUILDING:—A building is needed for instruction in Agronomy. One wing of the proposed building, The Farm

Machinery Laboratory, was erected in 1915. Provision should now be made for the erection of the main structure to provide crops laboratories, soils laboratories, class rooms, offices and storage rooms for supplies and equipment.

19. DORMITORIES:—Two dormitories have been erected designed to accommodate 66 students each. The number of male students enrolled in the college and school of agriculture and in the winter short courses is in excess of normal accommodations, resulting in an over crowding of living quarters.

It will not be wise to attract or receive additional students, until needed buildings and equipment are provided for adequate instruction to students now registered, nor will it be desirable to build additional dormitories until the money for maintenance of the institution as a whole be increased to an amount sufficient for the upkeep of the college at its present size.

20. SCIENCE HALL:—Agriculture rests upon science. It is no longer urged in any quarter that agricultural instruction should be empirical. It is no longer held that an apprentice course is sufficient for the college student in agriculture. The courses of study recommended by the Association of Agricultural Colleges provides that one-third of the time in the schedule of the four-year course be devoted to the sciences of Chemistry, Physiology, Botany, Zoology, Geology, Entomology, and Bacteriology.

At present the department of Botany is quartered on the second floor of the Horticultural Building and the department of Physics in the attic of the Horticultural Building, the department of Bacteriology on the third floor of the Dairy Building and the department of Zoology, Geology and Entomology in the Main Building. The laboratories in each case are inadequate in size, and the room thus occupied is needed for other purposes. The department of Chemistry occupies a separate building. The chemical laboratories are very crowded, and several courses have been omitted on account of the lack of proper facilities. It cannot be too strongly urged that a group of subjects fundamental to agriculture and occupying from one-fourth to one-third of the total time of the students during a four-year course of study shold receive recognition, and that adequate laboratories be provided both for study and research.

21. ADMINISTRATION BUILDING:—The present Administration building was erected in 1890 when the enrollment was about 100 students. The attendance has now doubled and the class rooms are too small. The construction is of wood, and the buildings and valuable contents, including the library, are in danger of loss by fire. The present building is now used for the following purposes: Offices of the President, Treasurer, and Secretary, Post Office, Library, College Store, class rooms for the departments of English and Economics, English and Elocution, German, French, History, and Mathematics; class rooms and laboratories for the department of Geology, Zoology

and Entomology; Museum of Natural History, Students' Infirmary, Printing Shop, Studio for the department of Music, and a suite of guest rooms.

It is evident from the many uses which this building serves that it cannot be dispensed with until another is erected to take its place. Moreover, the plan of the landscape architect calls for the erection of a fireproof Administration Building. The Administration Building should provide class room accommodations for the academic departments suitable for a student body of at least 400; offices for administration, the Post Office, Business Office; offices for the director of the Experiment Station and for the director of the Extension Service; temporary accommodations for the Library and Chapel.

SUMMARY.

The needs of the college for buildings and improvements are estimated for a period of six years. There may be a difference of opinion as to the relative importance of the several items in the budget, but in general of first importance is the provision of ample funds for the maintenance of the institution as its present size; second, provision of suitable buildings and equipment for the adequate instruction of the students now enrolled; and third, provision for the growth of the institution in number of students. It is believed that a plan for the future growth of the college will tend to a more economical expenditure of funds appropriated for its support.

SUMMARY OF THE NEEDS OF THE COLLEGE FOR BUILDINGS AND IMPROVEMENTS, ESTIMATED FOR A PERIOD OF SIX YEARS.

1.	Home Economics Building ..		$100,000.00	
2.	Dining Hall		66,600.00	
3.	Faculty Cottages			
	Four Single Cottages .....$	20,600.00		
	Four Double Cottage	42,100.00		
			62,700.00	
4.	Farm Improvements			
	Ice House	3,500.00		
	Drainage of Land	6,460.00		
	Improvement of Land	3,000.00		
			12,960.00	
5.	Temporary Chemical Laboratory		15,000.00	
6.	Poultry Buildings			
	Completion of Laying House..	500.00		
	Five 12x12 Colony Houses ..	625.00		
	Six 16x16 Colony Houses	1,200.00		
	Fencing	750.00		
			3,075.00	
7.	Student Infirmary		8,320.00	
				$268,655.00

8.	Addition to Dairy Barn	5,000.00	
9.	Forging Shop and Equipment	10,000.00	
10.	Concrete Road to Eagleville .		
11.	Addition to Water Supply...	10,000.00	
12.	Seed, Storage and Tool House for Experiment Station	5,000.00	
13.	Carpenter Shop	10,000.00	
14.	Apiary Building and Equipment	5,000.00	
15.	Ornamental Planting and Improvement to Grounds	3,000.00	
16.	Fruit Storage	15,000.00	
17.	Fire Protection	15,000.00	
18.	Agronomy Building	60,000.00	
19.	Dormitory for Young Men ..	100,000.00	
			238,000.00
20.	Science Hall	100,000.00	
21.	Administration Building	125,000.00	
22.	Library	125,000.00	
			350,000.00

Attention is invited to the report of the Director of the Experiment Station; to the report of the Director of the Extension Division; and to the financial statements that appear on the following pages.

Respectfully submitted,

CHARLES L. BEACH,
President.

THE AGRICULTURAL EXPERIMENT STATION

The following paragraphs present in very brief outline the scope of the Station's work during the two years covered by this report:

AGRONOMY DEPARTMENT, PROFESSOR SLATE IN CHARGE

The work of this department has covered the following subjects:

Tests of varieties and strains of the small cereal grains; tests of field and soy beans, and, in cooperation with the New Haven Station, tests of varieties and strains of corn for grain and silage; seed studies and variety tests of potatoes, corn and soy bean combinations for silage; availability of soil potash, and a project on fertilizer formulae.

Some valuable results will be ready to publish within a short time.

As a result of the testing of corn varieties for the last five years at both Stations, it has been possible to indicate to farmers in all parts of the state, a number of varieties which, in their particular section, will give satisfactory yields, and it is hoped that growers of certain high-yielding varieties may be encouraged to undertake careful seed growing as a business, to supply our own state, at least, with superior strains of seed corn.

DEPARTMENT OF ANIMAL DISEASES, DR. RETTGER IN CHARGE

The valuable work of Dr. Rettger on blackhead of turkeys, bacillary white diarrhea of chicks, and contagious abortion of cows, has been done in cooperation with the dairy and poultry departments and is described below in connection with the work of those departments.

DAIRY DEPARTMENT, PROFESSOR WHITE IN CHARGE

The dairy department has engaged in the study of some particulars of calf feeding, especialy regarding the liberal use of ensilage for young calves, and the feeding of milk in various dilutions with water as a substitute for skimmed milk.

The larger part of the work of this department, however, has been devoted to investigations connected with the infectious abortion of cows, which have been carried on jointly with the bacteriologist, Dr. Rettger. The question of the inheritance of the disease has been studied and also the possible spread of infection through the food. Other possible sources of infection are being investigated under strictly controlled conditions, with most promising results. One bulletin has already been issued giving a summary of the work done up to the date of issue, and the material for a further report, chiefly concerning food as a possible carrier of the disease is nearly ready.

This is perhaps the most immediately important work in which the Station is at present engaged, for the disease is the most serious which affects livestock in this state, and causes the largest money losses. The lack of funds sufficient to push the work to a prompt conclusion or to a point where it may yield great and immediate relief to the keepers of Dairy Stock is keenly felt.

POULTRY DEPARTMENT, PROF. KIRKPATRICK IN CHARGE

The Station has had general charge of the two egg-laying contests conducted by the College.

Valuable data regarding feed consumed, eggs produced and individual and flock records have been collected and published by the Station.

The data collected in the last seven years are to be brought together and discussed statistically by arrangement with the Carnegie Institution for experimental evolution.

The studies of pigmentation as correlated with egg production have been carried on in connection with these contests, and have yielded most important practical results, enabling poultrymen to cull from their flocks, without the necessity of trapnesting, those birds which were not paying for their keep, thus greatly reducing expenses.

Normal curves of growth have been determined for White Leghorns and Rhode Island Reds as a guide to experiments in feeding for growth.

The study of the influence of male inheritance on egg production is continued and also the study of blackhead of turkeys.

The experiments on the agency of the male in transmitting bacillary white diarrhea are still in progress, not having yet reached a definite conclusion.

The studies of blackhead in turkeys and of bacillary white diarrhea have been in collaboration with Dr. Rettger.

ZOOLOGICAL DEPARTMENT, PROFESSOR LAMSON IN CHARGE

The study of the effect of sub-normal temperatures on chick embryos during incubation has been finished.

The results indicate that the embryos can endure quite considerable changes of temperature during incubation, but that any cooling of the eggs at intervals during this period has no effect on their hatchability.

The life histories of cattle lice, and control measures have been studied and the results are published.

Some study has been given to the toxic effects of rose chafers when eaten by chickens.

In recent months Professor Lamson's work has been on "Control

Measures of the Body Lice of Soldiers" under the direction of the National Research Council.

The members of the Station Staff have rendered invaluable service to the State Council of Defense, chiefly through the committees on Food Production and Conservation, in all matters relating to agricultural production.

It has been felt by all of us that our special work must be neglected or abandoned just as far as was necessary to serve the state and nation in any way within our power in the greatest of all crises.

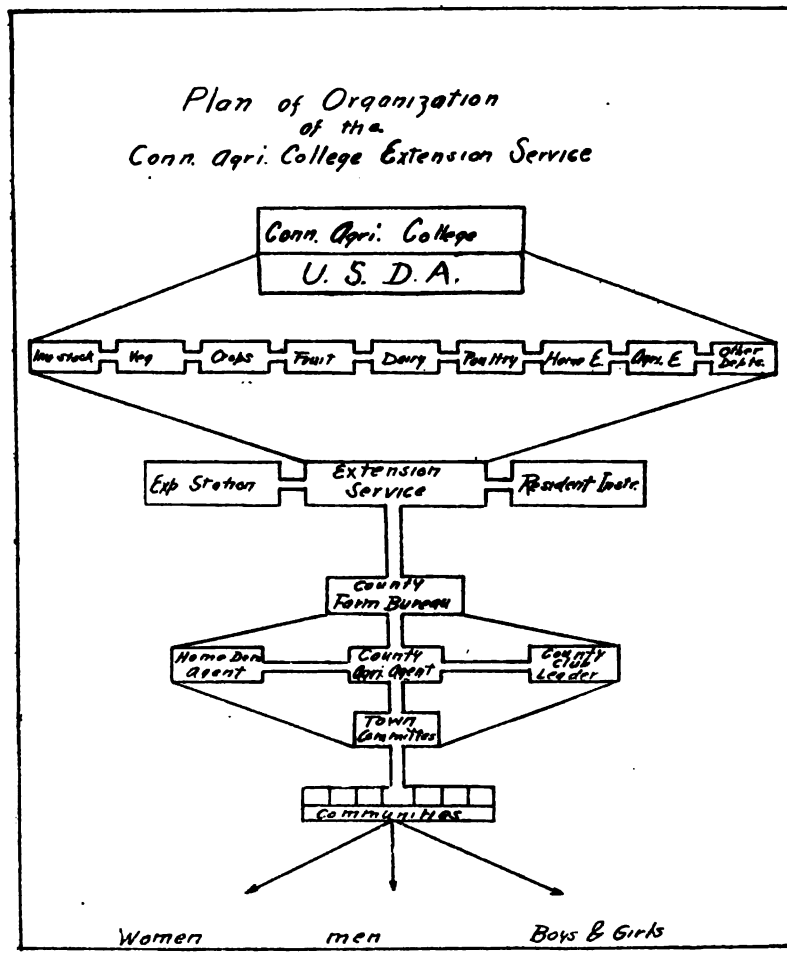
This Station, like every other public institution, has felt the pressure of the demand for special war service, the scarcity and inefficiency of labor and the curtailment of work made necessary by its greatly increased cost. All these things have seriously interrupted that even course which is so essential for investigation and experiment.

The need and the demand for agricultural investigation, however, was never greater than now. The work of the Extension department is to carry the results of the Station findings to the men on the farms. The Agricultural Colleges depend on these findings for advance in the teaching of both the science and the art of farming. The Station work is, therefore, fundamental to all advance in intelligent agriculture.

The Station has, therefore, felt obliged to ask, and hopes to receive, from the General Assembly a substantial addition to its income.

Respectfully submitted,

E. H. JENKINS,
Director.


Plan of Organization
of the
Conn. Agri. College Extension Service
Conn. Agri. College
U. S. D. A.
Live stock
Veg
Crops
Fruit
Dairy
Poultry
Home E.
Agri. E
Other Depts.
Exp Station
Extension Service
Resident Instr.
County Farm Bureau
Home Dem. Agent
County Agri. Agent
County Club Leader
Town Committee
Communities
Women
men
Boys & Girls

CONNECTICUT AGRICULTURAL COLLEGE EXTENSION SERVICE BIENNIAL REPORT 1916-1918.

H. J. Baker, Director.

ORGANIZATION—The Connecticut Agricultural College is divided into three divisions,—resident instruction, Experiment Station, and Extension Service. The several departments in the College are charged with teaching resident students, and with conducting experimental work and the extension service.

The Extension Service carries the College, the Experiment Station, and the U. S. Department of Agriculture to those who cannot come to the College, and aids in getting into practice on the farm and in the home practical and useful information which these institutions have made available through many years of investigation and experimental work. Practical farm methods, efficient household methods, and community organization are also constantly being studied by members of the Extension staff, for the purpose of application to homes and communities, which constitutes one of the most helpful phases of Extension work. An extension organization has been developed (see page 1 for plan of organization) with headquarters at Storrs and a farm bureau in each county, which reaches into every town and community in the State.

There are five main divisions of the Extension Service, all of which are intimately associated. These divisions are represented by—

1. Work of Extension Specialists.
2. County Agricultural Agent work.
3. Junior Extension, including Boys' and Girls' Club work.
4. Home Economic work.
5. Marketing.

The Extension Service developed by having first Extension Specialists in the important branches of agriculture and in Boys' and Girls' club work. Second came the County Agricultural Agents, with the County Farm Bureaus. Within the last two years the Farm Bureau has added to its staff Boys' and Girls' workers and Home Demonstration Agents in Home Economics work. State Leaders in Agricultural Agent work, Boys' and Girls' work, and Home Economics work are maintained jointly by the Agricultural College and the U. S. Department of Agriculture.

EXTENSION SPECIALISTS—The Extension specialists carry on their work through and in cooperation with the county workers. The county agent cannot be proficient in all branches of farming, in all phases of household work, and in cooperative and community organization. On the other hand, the county agents are more familiar with local conditions than Extension specialists. Hence, the two working together are able to render more efficient service than either can give

by working alone. The Extension specialists have worked together in doing systematic educational work along various lines. The most important of these are as follows:

EXTENSION SCHOOLS—Extension Schools continue to be one of our most effective methods of teaching. The school is conducted for four days, beginning Tuesday morning and continuing until Friday night. The local expenses are met by the community; all other expenses are met by the Extension Service. In most schools courses in agriculture and home economics are given. Experience has proved that not more than three courses in agriculture should be given in any one school. Local responsibility for securing attendance and making all necessary local arrangements is necessary for the success of the school. The schools in agriculture are granted only in real farming communities. The home economics school can be extended to urban communities. During the past two years twenty-one schools in agriculture and nineteen in home economics have been held, with a total attendance of 697 persons.

FARMERS' INSTITUTES—Farmers' Institutes in Connecticut are conducted by the Extension Service. Our Institute programs are for one day only. Institutes are granted upon request from the community or the County Agent. The Institute still occupies an important place in this State as a means of inspiration and instruction in farming and household problems. During the past two years forty Institutes have been held with a total attendance of 2257 persons.

FARMERS' WEEK—Farmers' Week has become an annual event at Storrs. The date set for the Farmers' Week is the first week in August. There has been an average attendance in the last two years of approximately 250 persons. Although in view of the severe farm labor shortage, this number represents a fair attendance, it is hoped that in the future our Farmers' Week at Storrs will be much more largely attended than ever before. The program is such as should attract men, women, boys and girls. This meeting is held in cooperation with the State Agricultural societies.

FAIR EXHIBITS—For the past two years the Extension Service has cooperated with the Council of Defense in fair exhibits. The Extension staff has made up exhibits and has been in attendance at the fairs. The Council of Defense has financed the exhibits and taken care of routing. Through this cooperation it has been possible to reach a large number of fairs. A total of fourteen in 1917 and twelve in 1918 were attended. (A number of fairs were given up in 1918, on account of the influenza epidemic.) Two complete exhibits occupying tents 40x80 and 40x60 respectively have been sent to the fairs. On the whole these exhibits attracted more interest at the smaller agricultural fairs than at the larger fairs. The fair exhibit work, although difficult to measure in actual results, has been without question very much worth while.

OTHER EXTENSION ACTIVITIES.

FRUIT GROWING—Available funds have not permitted the Extension Service to take up fruit work as extensively as the industry in this State warrants. Through a cooperative arrangement with the Horticultural department of the College an endeavor has been made to answer all inquiries and occasionally to make important farm visits upon request. It is hoped that another year sufficient funds will be available to provide a full time Extension man for fruit work.

VEGETABLE GARDENING—The Extension Service has no specialist in vegetable growing. During the past two years, however, the Extension Service has cooperated with the Committee of Food Supply of the Council of Defense in stimulating the home garden movement. As a result, thousands of families who had never thought of having a garden before have had gardens. A large number of these families will never be satisfied again without a garden in which to raise the family supply of vegetables. It is hoped that this interest in the home garden may be maintained and developed to the point where every farm and every suburban home that has a small piece of land will have a garden with which to supply the vegetable needs of the family. The Extension Service, as soon as funds permit, contemplates having a well-trained vegetable gardening man on its staff, who will not only head up this garden movement, but who will be available to assist market gardeners in their problems.

COTTAGE CHEESE WORK—During the summer of 1918 Miss Eleanor Moss was added to the Extension staff to give demonstrations to the housewives in making cottage cheese. The purpose of this work was to save the surplus skim milk by converting it into edible form as a meat substitute. A total of 118 demonstrations and meetings was held, with a total attendance of 3,500. There was very general interest among the country women especially. This probably was one of the most successful pieces of demonstration work that the Extension Service has conducted. It was financed entirely by the Dairy Division of the U. S. Department of Agriculture. The work was discontinued at the close of the summer when the milk surplus had disappeared. This demonstration work would undoubtedly be of great value each year just prior to and during the flush period for milk.

ENTOMOLOGY—Through the cooperation of the Bureau of Entomology of the U. S. Department of Agriculture an Extension Entomologist was placed in Connecticut in March, 1918. His efforts have been devoted mainly to the control of vegetable insects. The greatest value of this service has been in teaching home gardeners how to protect their vegetables from insect pests, and in assistance to supervisors of community and city gardens. The work has been supported entirely from Federal Emergency funds. In all probability it will be continued during 1918-1919.

COUNTY AGRICULTURAL AGENTS—The County Agricultural Agent work has fully established itself on a permanent basis during the past two years. Not only have farmers come to appreciate the County Agricultural Agent as being indispensable in improving agricultural conditions, but men in other lines of business have indorsed the agricultural agent work, and contributed to the support of it with their influence and financial backing.

JUNIOR EXTENSION, INCLUDING BOYS' AND GIRLS' CLUBS—The Boys' and Girls' work has grown rapidly under the stimulus of war conditions. Each county in the State now has a county Boys' and Girls' worker. No work has been more enthusiastically supported than our work with juniors. Men and women have volunteered in large numbers as local leaders for the purpose of assisting the boys and girls in carrying through their work to completion. This work among our juniors is the most fundamental and far reaching work being done by the Extension Service, since it is work done with those who in a few years will be in charge not only of our economic but also of our social, educational, religious, and community welfare. Giving to the boys and girls useful employment, and at the same time creating the right point of view towards life is a service the value of which can not be overestimated. It is fortunate that the Extension Service early in its existence began this work. The Boys' and Girls' work has a very close relationship to the school system and there is need that schools in the State may be brought into closer relationship with the Junior Extension work. A carefully coordinated and well defined program between the Extension Service of the College and the school system can not fail to be of the highest value to the boys and girls of the State.

HOME ECONOMICS—The urgent need for conservation of food supplies, the necessity for maintaining the health of the family and for carrying on our household work with the decreased labor supply resulted in Congress appropriating to the Department of Agriculture sufficient funds to inaugurate the home economics work on a more extensive scale. The development of the household program to meet the fundamental problems of the home and the community especially with reference to conservation of labor, proper recreation and in maintaining the health of the family will perform to the State and the nation a service of the utmost importance. The home economics work also constitutes one of the most effective means for Americanization of our citizens of foreign nationality. It should be of increasing service to both rural and urban communities.

MARKETING—Marketing is another leading phase of our Extension activities. Though the marketing work has been under way only two years, its development has already made considerable progress. The work has grown far beyond the capacity of one man. This last year, due to the support from the Bureau of Markets of the Depart-

ment of Agriculture, four assistants were provided to supervise public wholesale markets in Bridgeport, New Haven, Hartford, and Waterbury respectively. This market reporting service has met with very general demand, and its extension to other large cities, and to smaller communities is being called for. Already plans are under way to bring this about, provided State funds can be secured to meet the Federal contribution. The marketing work is essential to the development of a sound, prosperous agriculture. The marketing work renders a service to the consumer as well as to the producer.

COOPERATION WITH THE U. S. DEPARTMENT OF AGRICULTURE

The U. S. Department of Agriculture has been from the beginning of organized Extension work a very vital factor in the development of our program. Beginning with the support of some of the more important State Extension specialists, the Department has extended its financial assistance to the County Agricultural Agent, to Boys' and Girls' Club leaders, and the Home Demonstration Agents. The rapid development of the Extension Service has been due in a large measure to the cooperation received from the U. S. Department of Agriculture.

COOPERATION WITH THE FOOD COMMITTEE OF THE STATE COUNCIL OF DEFENSE AND WITH THE U. S. FOOD ADMINISTRATION.

Upon the declaration of war, the trustees of the College offered the services of our institution to the Food Committee of the State Council of Defense. The Extension Service upon invitation placed our State Leader of County Agents, Mr. I. G. Davis, in the office of the Food Committee in Hartford. This was a fortunate arrangement in that the Council of Defense was brought into intimate relationship with the Extension Service. Through this connection our agricultural specialists were brought into consultation in the making and development of the Food Committee's program. Our Farm Bureaus with their agents became the active field agents of the Food Committee in all agricultural production work.

The Extension Service also placed Miss M. E. Sprague at the service of the Food Administration to have charge of the food conservation work. Miss Sprague was made Home Economics Director for the Food Administration in Connecticut. In this capacity she not only coordinated all women's organizations in the State into one harmonious agency, but she also contributed invaluable service in developing the work of our Home Demonstration Agents in such a way as to make their energies count most effectively in food conservation. At the same time her work has resulted in placing the Home Demonstration work on such a basis that the housewives generally appreciate the value of this assistance in meeting their fundamental home problems. As in the case of our Agricultural Agents, the women agents of the Extension Service and the Farm Bureaus have been a strong force in carrying through successfully the Food Administration program.

The Junior Food Army Committee of the Committee of Food Supply, with Mrs. Samuel Russell as chairman, was responsible in a large measure for the enlistment of fifty thousand boys and girls in food production and food conservation. The Boys' and Girls' Club work which the Connecticut Agricultural College and the U. S. Department of Agriculture have been carrying on for several years served as a basis for developing the Junior Food Army program. Mr. A. J. Brundage, State Leader, for Junior Extension work, and the County Club Leaders, carried out the plans and program of the Junior Food Army Committee. Again the work of the Food Committee of the Council of Defense was carried out through our already existing Extension organization, resulting in harmonious relationships and successful achievement.

The marketing work of the Council of Defense was coordinated with the marketing work already begun by the Extension Service. Mr. Guy C. Smith, our Extension Agent in Marketing, became the representative of the Food Committee of the Council of Defense in all matters relating to marketing and distribution of food products. This connection opened up many possibilities, and was responsible for important developments in our marketing program.

The publicity work of the Food Committee was also headed up by the publicity agent of the Extension Service, Mr. Glenn H. Campbell, until his resignation. After that time the work was carried on by Professor William F. Kirkpatrick of the Poultry Department of the College. Probably no more important work was carried on during the year than that which resulted from the work done in this connection. The educational publicity in connection with our agricultural production and home economics program has been in harmony with and a part of the field activities of our College and Farm Bureau agents. Through this connection with the Food Committee of the Council of Defense it has been possible for us to get much greater response on the part of the press than we have ever been able to get under normal condition. It is hoped that the connection which has been established during the war will be maintained.

COORDINATION OF EXTENSION ACTIVITIES—One of the most important problems in the development of our Extension Service is the proper coordination of the different lines of work. Our entire Extension staff appreciate the necessity of no duplication, and are all working together to that end. As a result of series of conferences to aid proper coordination of all Extension activities, a program committee on Extension work has been appointed by the Extension Director. This committee considers all plans of work and programs before they are finally adopted.

EDITORIAL DEPARTMENT—Since our Extension staff can come in personal contact with only a small percentage of our people, it has become necessary that the Extension Service make use of other means of Extension teaching. The medium of the press is without doubt one

of the most effective means for reaching the great majority of people. Hence an editorial and publicity department has been established as a part of our Extension Service. A well-trained agricultural journalist and newspaper man, Mr. Walter Stemmons, is now in charge of this work, succeeding Mr. Glenn H. Campbell, who resigned to go into the Army. His duties are to supervise and direct all educational publicity, edit all publications of the Extension Service, advise with the County Farm Bureaus in publicity matters, and have charge of the Extension mailing room. The work of this department during the past year has been principally with the Food Committee of the Council of Defense in charge of its publicity. The result during the past year of using the press as a means of Extension teaching has demonstrated the absolute necessity for maintaining adequate, well-organized educational publicity. Only by securing and maintaining cooperation on the part of the press can the Extension Service function in its fullest capacity.

The publications of the Extension Service during the past two years have been issued in cooperation with the Food Committee of the Council of Defense. They are as follows:

EXTENSION CIRCULARS.

Joint Circular of Information No. 4—Selecting Rations for Dairy Cows. G. C. White, Karl B. Musser. February, 1917.

Extension Circular No. 10—Farmers' Institute Announcement, 1917. December, 1916.

Circular No. 11—Is Milk, Milk? H. F. Judkins. 1917.

Circular No. 12—Increase and Conserve Poultry Products. R. E. Jones. April, 1917.

Extension Circular No. 13—Growing Crops to Reduce the Feed Bill. William L. Slate, Jr. April, 1917.

Extension Circular No. 14—Orchard Spray Calendar. S. P. Hollister. April, 1917.

Extension Circular No. 15—Common Diseases and Insects Attacking Garden Plants. A. T. Stevens, G. H. Lamson. May, 1917.

BULLETINS.

Bulletin No. 2—Poultry Selection, Care and Management (Revision). R. E. Jones.

Bulletin No. 4—Home Canning. May, 1917.

Bulletin No. 5—Farm Manure and Its Housing. B. G. Southwick, F. W. Duffee. July, 1917.

Bulletin No. 6—Clover. B. G. Southwick. June, 1917.

Bulletin No. 7—Studies from the Survey on the Cost of Market Milk Production. Karl B. Musser, G. C. White, B. A. McDonald, H. F. Judkins. July, 1917.

Bulletin No. 8—Poultry Farm Management. R. E. Jones, I. G. Davis, B. A. McDonald. July, 1917.

Bulletin No. 9—Home Cheese Making. H. F. Judkins, P. A. Downs. September, 1917.

Bulletin No. 10—A Plan for Short Term Farm Loans in Connecticut. Guy C. Smith. November, 1917.

Bulletin No. 11—Home Curing of Pork. J. A. Simms. November, 1917.

EMERGENCY FOOD SERIES.

Preserving Eggs in Water Glass.
Cottage Cheese—An Inexpensive Meat Substitute.
Save the Sugar for the Soldiers.
Practical Methods of Drying Fruits and Vegetables.
Eat Less Meat.
Eat Less Wheat—Try Wheatless Meals.
Pickles—Chow-Chow—Chili Sauce—Sauerkraut, Etc.
Potatoes in the Diet.
Jellies, Jams, and Marmalades.
Peaches; Their Use and Conservation.
Meat Substitutes.
Wheat Substitutes.
Milk.
Cutting the Meat Bills with Milk.

LOOKING TO THE FUTURE.

The war has advanced the development of the Extension Service several years. The demands for assistance have increased many fold over the pre-war period. In order to meet the problems ahead of us there must be, therefore, no retrenchment in our activities. Instead it is imperative that our Extension organization be maintained on its present basis, extended to include other lines of work and developed to a higher state of efficiency. I wish to emphasize especially the urgent need of developing the marketing work, our junior Extension Service including the work with boys and girls and our home economics program. We should also have a specialist in fruit growing and in market gardening.

Extension work is of such a nature that our policy must continue to be that of rendering practical service. Extension workers are constantly dealing with vital problems on the farm, in the home and in the community. In order that the Extension Service may give the assistance which will aid in the proper solution of the problems on the farm, in the home and in the community, it is necessary that our employees, in all branches of our work, be men and women, of the highest ability. With limited funds it is better policy, I believe, for the Extension Service to do a few things well than to attempt to carry out a more extensive program with inferior men and women. At the same time, however, it is our obligation to meet the demands for assistance which are being made upon us and consequently we must look forward to the time when those phases of our work which have not yet been taken up may be included in our program. The largest limiting factor up to the present time in the development of our

Extension Service has been inadequate State appropriations for proper cooperation with federal appropriations available for Extension Service. Every endeavor should be made to secure from the next session of our legislature sufficient State appropriation to enable us to take up and develop those phases of our work to which special reference has been made.

WORK OF COUNTY AGRICULTURAL AGENTS.

I. G. Davis, County Agent Leader.

* L. A. Bevan, Fairfield County
* E. A. Brown, Hartford County
* A. W. Manchester, Litchfield County
* John H. Fay, Middlesex County
* L. F. Harvey, New Haven County
* A. B. Cook, New Haven County—Waterbury
* F. C. Warner, New London County
* John E. Gifford, Tolland County
* B. W. Ellis, Windham County

*County Agricultural Agents, employed jointly by Connecticut Agricultural College Extension Service and County Farm Bureaus.

GROWTH OF WORK—In April, 1914, New London County organized a Farm Bureau and the first County Agricultural Agent in Connecticut began work. On December 1, 1916, there were for the first time County Agricultural Agents and organized Farm Bureaus in every county in Connecticut. Since that time, five counties, namely New London, Windham, Tolland, Hartford, and New Haven, have employed assistant county agents. These assistant agents, altho primarily agricultural men, have devoted their efforts to a considerable degree to Junior Extension Work. There have been during the past year a total of fourteen agents and assistant agents devoting full time to county agent work.

FUNDS SUPPORTING COUNTY AGENT WORK—While emergency agricultural appropriations have made possible the employment of assistant agents in some counties; Federal, state, county, College and town appropriations and contributions, which supported county agent work in the past, have been sufficient for the past two years. The greatly increased cost of operating farm bureaus the past two years has not been due to an increased agricultural department but to the addition of the exceedingly important household economics and boys' and girls' departments. The total cost of operating the average farm bureau agricultural department at the present time is approximately $4500 each year in addition to emergency appropriations.

SUPERVISION—The work of the county agricultural agents is directed jointly by the Agricultural or Executive Committee of the farm bureau and the County Agent Leader representing the United

States Department of Agriculture and the Connecticut Agricultural College. The county agent carries out a program determined by his Agricultural Committee and adapts that program to each community by meeting the local director and committee and planning the work to be done in this community.

MODIFICATION OF PROGRAM DUE TO WAR CONDITIONS—The war has wrought a great change in the program of the agricultural departments of the farm bureaus. The demands for the kinds of work previously done have greatly increased. There has been a greater call than ever before for assistance from the Extension Service of the College and the U. S. Department of Agriculture. The demand for assistance in cooperative organization has increased. Calls from farmers for advice and assistance have been multiplied many fold. All these calls the county agents have attempted to meet.

But the great work of the agricultural departments during the war has not been to urge increased production, or to conduct educational demonstrations, but to help the great body of patriotic farmers supply themselves with labor, labor saving machinery, credit and the raw materials of production. In brief, the farm bureaus have recognized that production would be limited, not by a lack of the will to produce, but by a shortage of the means of production. To help to remove this shortage has been the county agents' main work.

MILK SELLING ORGANIZATION—The most important work done during the biennium beginning October 1, 1916, was the assistance rendered to dairymen in effecting the present state organizations for selling milk. For a period of four months the county agents devoted themselves almost exclusively to assisting dairy farmers on this project. In the organization of the Connecticut Milk Producers' Association and the Connecticut units of the N. E. M. P. A., the county agents were an important factor. Some assistance was rendered in the organization of the Farmers' Dairy Company of Bridgeport. The results of this organization work have been far reaching. Thru the advances in prices secured the dairy industry of the state has been saved and every dairy farmer in Connecticut has directly or indirectly profited.

EXTENSION SCHOOLS, INSTITUTES, ETC.—During the winter of 1916-1917 and again during 1917-1918 the county agents assisted the Extension Service of the College in arranging for extension schools and farmers' institutes and in many cases participated in the programs.

In the two years just ending, 21 extension schools with a total attendance of 697, and 40 institutes with a total attendance of 2257 were held.

SURVEY ON COST OF MILK PRODUCTION—In March, 1917, the county agents cooperated with the Connecticut Agricultural College in making a survey of the cost of milk production on about twenty-five farms in each county. The figures showed the cost of milk production

for the year ending May 1, 1917, to be $.05.53 per quart and the price for the month of April of that year to be $.06.25 per quart. The average price received was $.0487. The survey was extensively used by the regional milk commission in adjusting the price of milk and enabled representatives of the farmers to present their case with conviction at various hearings.

EMERGENCY WAR PLANTING—During the spring of 1917 the county agents and various representatives of the Agricultural College were active in stimulating the organization of various city and manufacturers' movements for food production in cities. It is estimated that from 30,000 to 40,000 men, producers of food, received instruction and supervision thru the county agents in this way in 1917. During 1918 this movement became more definitely organized in the cities and is at present being developed in many cities under a special committee of the Council of Defense Committee of Food Supply. In 1918 the Farm Bureaus in three counties appointed special county agents for food production work in cities. This work was seriously handicapped by a late start. D. E. Warner, special agent in Fairfield County, and J. H. McDonald in New Haven County, both accomplished valuable results.

The work done in Bridgeport under the leadership of Mr. Warner and the Bridgeport War Bureau was outstanding. In five weeks Mr. Warner visited 2000 war gardens, conducted organized spraying demonstrations on the gardens of employees of various manufacturers in the city, organized a potato growing enterprise of twenty-five acres with the Police and Fire Departments and rendered much service of an advisory nature.

The work in New Haven County had been well organized early in the season in connection with the manufacturers in New Haven and Waterbury. Meriden was well supervised by a special city agent, and Mr. McDonald, the special county agent for food production in cities, devoted his efforts to smaller cities of the county. He was well received and laid the ground for constructive work next year. The city work attempted by the farm bureau in connection with the manufacturers in Hartford County was not a success. In both New Haven and Fairfield Counties, employers have noted that the possession of substantial gardens tends to make employees more contented and to prevent the shifting of labor which is responsible for great economic loss. They also note the benefits of healthful outdoor recreation which these gardens afford to thousands of families.

FUTURE DEVELOPMENT OF CITY WORK—The future development of food production work in cities is an important problem and one which may well engross the entire attention of a special force engaged upon a permanent basis. The present tendency is for the city rather than the county to become the unit of organization. This tendency is undoubtedly a sound one. The county agents, altho their field is distinctly rural, will encourage in every way the development

of this movement. Whether it develops as an integral part of the farm bureau or not, its friends should not make the mistake of failing to link up very closely with the state and national agricultural extension organizations. The importance of this work in relation to the problems of labor shifting, and public health, as well as in reducing the cost of living and promoting the utilization of waste land and fertilizer, makes it one that should receive special attention in an organized way in every city of the state.

HELPING FARMERS OBTAIN SEED—The spring of 1917 developed a shortage of seed potatoes, seed beans and buckwheat. The Food Committee of the Council of Defense brought into the state quantities of these seeds to meet the situation. The farm bureaus assumed a large measure of responsibility for seeing that the needs of the farmers were met. Acting independently the county agents did much to relieve the situation. A total of 3500 bushels of seed potatoes, 125 bushels of buckwheat, 150 bushels of seed corn, 110 bushels of seed beans and sixty bushels of soy beans were located by county agents for farmers who were unable to find their own seed.

1918 SEED CORN CRISIS—In 1918 the only critical seed situation was in relation to corn, and here the conditions were the worst that have been experienced in a generation. The county agents have never devoted themselves more intensively to any one piece of work than to the campaign to meet this extremely serious situation. Under the able leadership of B. G. Southwick, Extension Agronomist, County Corn Shows were held in every county, early in the season before we knew conditions were serious. Two hundred and fourteen farmers entered fifty-ear exhibits at these shows. Germination tests were made upon these exhibits. These shows first revealed the fact that seed corn was becoming bad. Every means of publicity at their disposal was focused by the farm bureaus upon this situation. In Windham County corn meetings and suppers were scheduled for every town. More than seven hundred samples were sent personally by the county agents to the New Haven Experiment Station for testing. It was found that only about thirty per cent of this corn was fit for planting; in Fairfield County about ten per cent.

In February the United States Department of Agriculture asked Connecticut to send all her extra seed corn to the North Central states, where the seed had been almost entirely destroyed. The county agents handled the business details and the Experiment Stations made the official tests. Six carloads, which brought the farmers more than $15,000, were shipped to North Dakota and Wisconsin.

Late in March an emergency seed corn committee was brought into existence by the Committee of Food Supply. Thru this Committee the rural ministers brought the seriousness of the situation to the attention of their congregations and thru the State Board of Education reading lessons on the situation and the method of testing were placed in all rural schools. High schools were asked to test seed corn for farmers in their community.

The following table shows statistically the results of county agent activities in this work:

	No. of 50-ear Exhibits at Corn-shows	No. of Samples Taken	Bushels Sold Through Farm Bureau	Sold to Gov't	Money rec'd from Federal Gov't
Hartford	28	167	2800	2010	$3543
New Haven	45	107	1050	700	2909.77
Middlesex	18	92	805	580	
New London	15	50	100		
Windham	18	80	100		
Fairfield	25	60	200		
Tolland	28	114	100	591	2512
Litchfield	37	47	300		
	214	717	5455	3881	$13964.77

HELPING FARMERS OBTAIN LABOR—In March, 1917, the farm labor situation began to become somewhat acute. In an effort to meet the situation the county agents made every possible effort to obtain labor for farmers. They cooperated with existing labor organizations but for the most part depended on their own resources. They had the thorogoing cooperation of the Boys' Working Reserve in securing this type of labor.

In central and western Connecticut much good work was done. In justice to the county agents of eastern Connecticut it must be said that no agency thus far has been able to find adequate labor for the farms in that section. Paul W. Ives in New Haven County, Otis Moore in Hartford County and Allen W. Manchester in Litchfield County are agents deserving special mention for their success in devising means of meeting the labor problems. Interesting, and in some cases successful, experiments have been worked out in using convict labor and boys camps, particularly in New Haven County.

In 1918 the Federal Employment Service representing the U. S. Department of Labor took over control of the labor activities in this state. The Boys' Working Reserve and the Woman's Land Army became affiliated with them. The farm bureaus placed themselves at the service of this organization in matters connected with labor and were asked to act as an agency for locating labor on farms. A satisfactory and mutually helpful division of work has resulted. The following table shows the labor, man and boy, regardless of source, which has been placed on farms by the farm bureaus during the past two years:

	1917		1918	
	Men	Boys	Men	Boys
Fairfield			105	32
Hartford	545		600	25
Litchfield	48		55	8
Middlesex	162		24	63
New Haven	1000	75	642	455
New London	25		15	8
Tolland	16		50	50
Windham	9		15	21
Total	1805	75	1506	662

During the past year Elijah Rogers, Farm Labor Specialist of the Department of Agriculture, with offices with the Federal Employment Service, has contributed much to the solution of the farm labor problem. The county agents will continue this work as long as it does not constitute a duplication of effort, and as long as it is the desire of the Council of Defense for them to continue.

POULTRY SELECTION DEMONSTRATIONS.

1917 CAMPAIGN—One of the most successful and clean cut educational campaigns of the year 1917 was the drive for the elimination of non-productive hens. This was conducted by the county agents under the leadership of and with the assistance of R. E. Jones, Extension Poultryman, and Prof. W. F. Kirkpatrick, head of the Poultry Department of the Connecticut Agricultural College. The Connecticut Council of Defense Committee of Food Supply gave invaluable support thru its publicity department. The County Agents arranged and advertised the demonstrations. Mr. Jones, Prof. Kirkpatrick and their assistants did the actual demonstrating.

1918 CAMPAIGN—The 1918 campaign is being carried out at the present time under the same direction and leadership and with the same demonstrators. An attempt is being made this year to reach more communities than last and to reach those sections which have not heretofore received demonstrations. Following is a statistical report of poultry selection demonstrations this year as far as they have proceeded.

In seventy-nine demonstrations given in sixty-nine different towns in the State, 1,504 farmers were instructed in the methods of selecting non-productive birds. In attendance at the demonstrations and in the number of birds pledged for selection, Fairfield County easily leads the State. In attendance at demonstrations, Hartford County led, 302 farmers having attended her eight demonstrations. This speaks well for the efficiency of the advertising methods used by County Agent Brown.

Following is an itemized report of the demonstrations held by counties:

County	No. of Demonstrations	Attendance	Pledge Cards Received	Birds Pledged for selection
New London,	14	102	44	2983
Average,		7.2	2.7	186.4
Windham,	11	150	94	8965
Average,		13.8	8.5	815.9
Middlesex,	2	64	10	515
Average,		32	5	257.5
Tolland,	2	17	3	65
Average,		8.5	1.5	32.5
New Haven Section,	10	179	68	8112
Average,		17.9	6.8	811.2
Waterbury Section,	5	76	24	4465
Average,		15.2	4.8	893
Hartford,	8	302	132	11998
Average,		37.7	16.5	1499.7
Fairfield,	12	367	91	14760
Average,		30.5	7.5	1230
Litchfield,	13	242	64	6621
Average,		18.6	4.9	509.2

In these seventy-nine demonstrations a total of 8,442 hens were handled by the demonstrators. Of these, 5,016 were kept as good producers and 3,426 were condemned as slackers. As a result of removing these 3,426 hens, which constituted 37.1% of the flocks handled, egg production was decreased only 6.2%.

In addition to these seventy-nine demonstrations, the method of selecting non-productive hens was demonstrated at fairs in every county in Connecticut. In some counties continuous demonstrations went on from the beginning to the end of the fairs. A bulletin on the methods of selection was printed and circulated throughout the State by the State Committee of Food Supply and attractive posters were placed in every post office, railroad station, library and town hall in the rural sections of Connecticut, calling attention to the necessity of eliminating non-productive birds. The result of such a campaign it is hard to estimate, but we believe we are conservative in saying that at least 2,500 farmers in Connecticut have received definite instruction in the methods of eliminating non-productive birds.

THE SLACKER HEN DEMONSTRATIONS FOR 1918.

Farmers and farmers' wives to the number of 1,265, attended demonstrations in selecting non-productive hens.

The "slacker hen" campaign carried on this year by the Extension Poultry Department in cooperation with the County Farm Bureaus has been even more successful than that of last year.

In 81 demonstrations given in 75 towns, 1,265 persons were in attendance and 564 flocks, representing 38,965 fowls, were pledged for immediate culling. In number of towns having demonstrations and in number of demonstrations, Litchfield County led the state. In total attendance Hartford County led.

County	No.	Attended	Pledge Cards Received	Birds Pledged for Selection
New London	7	91	42	2888
	Average	13	6	412.5
Windham	10	155	54	4161
	Average	15.5	5.4	416.1
Tolland	10	120	42	5784
	Average	12	4.2	578.4
New Haven	10	182	82	7227
	Average	18.2	8.2	722.7
Hartford	16	322	162	10393
	Average	20.1	10.1	649.5
Fairfield	5	86	22	1566
	Average	17.2	4.4	313.2
Litchfield	23	309	160	6946
	Average	13.4	9.4	408.5
Total	81	1265	564	38965

In these 81 demonstrations a total of 9,664 hens were handled by the demonstrators. Of these 5,898 were kept and 3,766 were rejected. The average daily egg production for one week previous to the demonstrations was 2,611 eggs while for the week following the demonstra-

tions it was 2,361 eggs. There were 3,766 hens, or 39% of the flock, marketed with a drop of only 250 eggs, or 9.5% of the production.

The success of the year's campaign following that of last year's is a warranty of the value of such demonstrations, the financial value of which can be measured in dollars and cents and easily proved.

A detailed report of this campaign by towns for both 1917 and 1918, prepared by the Extension Poultryman is on file in the office of the County Agent Leader at Storrs.

AGENTS OF FEDERAL GOVERNMENT.

The county agents as employees of the United States Department of Agriculture have been required to act as its agents or as agents of the War Department in several matters of importance to the farmers. The work of this nature done by the county agents is herewith summarized.

a. **Sale of Seed Corn.** They acted as agents of the U. S. Department of Agriculture in sampling and arranging the purchase from farmers of 3881 bushels of tested seed corn at $4.25 per bushel.

b. **Purchase of Nitrate.** When the government commandeered our import of Chilean nitrate a certain amount was set aside for distribution to farmers for crop production. The county agents were required to act as agents of the government in its distribution. Following are the amounts of nitrate sold in the several counties in this way:

New Haven	69.2	tons
Hartford	75.	"
Middlesex	25.5	"
Fairfield	12.	"
Litchfield	10.	"
Windham	7.	"
Tolland	12.85	"
New London	8.5	"

Difficult transportation conditions delayed delivery until extremely late in the season and several of the county agents were obliged to go to New York and make special arrangements for delivery. The transportation committee of the Council of Defense gave valuable assistance in this work.

c. **Approving Furloughs.** Under an act of Congress of March 16, 1918, power was given the War Department to grant furloughs to enlisted men to assist in agricultural work for short periods during the planting and harvest season. Every recommendation for such furlough required the concurrence or dissent of the county agricultural agent as representative of the Department of Agriculture in his county.

d. **War Emergency Threshers Report.** Under the provisions of an act of Congress passed August 10, 1917, the Department of Agriculture is required to secure reports from farmers and threshermen of all wheat and other grains threshed by them. The county agents

as representatives of the Department of Agriculture are made responsible for securing these reports in each county. Returns from all threshing done in the county are telegraphed to Washington on the last day of the month.

AGRICULTURAL CENSUS.

From the beginning of the war there had been a strong feeling on the part of the Council of Defense, the Agricultural College and Farm Bureau officers that the agricultural program had been severely handicapped by lack of definite information as to actual agricultural resources and conditions in the state. Various abortive attempts were made during the first year of the war to bring about such a survey.

In February, 1918, County Agent A. W. Manchester of Litchfield County with the support of his county agricultural committee and the President of his farm bureau proposed a plan for an agricultural survey to be taken in Litchfield County by the farmers themselves under the authority of the Council of Defense. The plan was adopted and thru the support of the Council of Defense carried thru to a successful conclusion. The county agent was made county supervisor of the census, and various officers of the farm bureau were appointed assistant supervisors. The War bureaus in each town were put in charge of the local census taking and the best farmers in each community secured as census takers. With the exception of one town the census was secured as per schedule, most of the work being done in two days. Over three hundred farmer census takers were at work at one time in this county. The census was such a success that Hartford, New Haven, Tolland and Fairfield County Farm Bureaus immediately requested the support of the Council of Defense in taking agricultural surveys in their counties. One thousand census takers in these counties secured the desired information in a few days.

In the five counties in which the agricultural census was taken, records were secured on slightly more than 13,000 farms.

The work involved in taking this census would, however, have been of little value without adequate means of making its results available. Fortunately such means were at hand. George S. Godard, State Librarian, placed himself, his corps of skilled workers and his equipment at the disposal of the Council of Defense and farm bureaus for sorting, checking, coding and tabulating the results of the survey. As a result every part of this mass of material is immediately available to any agricultural agency in the state. The State Librarian will remain custodian of the original records.

USES OF THE CENSUS—The Agricultural census has already been of much value. It has been used in the following ways:

1. In locating all plantings of small grains and in locating available reaping and threshing machinery. As a result of the definite information secured means have been found of relieving reaping and threshing machinery shortage thruout these five counties.

2. In supplying farmers with labor. The returns of the census have served as a basis for the general farm policy and many farmers supplied with labor as a result of their replies to questions asked.

3. In assisting farmers to buy or sell needed products. The list of live stock and seed wanted and for sale have been published or distributed in various ways.

4. In providing complete lists of all farmers and of all farm resources in the counties. Thru these lists farmers have been reached on many matters of importance to themselves.

5. In forming a background of fact for making out the agricultural problems of the various towns and counties. The agricultural program in many sections has been based on the census. Its results are at all times proving of value to the various towns and counties of the state.

CENSUS NEXT YEAR—There seems to be a strong feeling among the farmers in all the counties in favor of repeating this survey next year. The governor has written a special letter urging it and the Council of Defense is prepared to stand solidly behind the farm bureaus in carrying it out.

FARM MACHINERY WORK.

The two greatest changes in conditions which our dairy and general farmers have had to meet as a result of the war have been

1. A constant decrease in labor supply.

2. A constantly increasing cost in the price of grain and mill feeds upon which our dairy industry has so largely depended.

These two changes have made the problem of farm machinery an important one,—the first directly, and the second indirectly.

The increased price of grain and mill feeds, forcing our farmers to grow better roughages and more grains on their own farms, and the changes in Farm Management resulting from shortage of labor, have both served to increase small grain acreage at a time when from almost total neglect of small grains sowings our farms are sadly lacking in reaping and threshing machinery. Interest has centered very largely in obtaining reapers, binders and tractors. The efforts of the county agents have therefore been centered on these machines.

Immediately following the agricultural survey, the county agents, in most cases acting under instructions of their agricultural or executive committees, took up the problem of harvesting and threshing machinery. The description of the work done in Watertown, Columbia and other towns will serve to show how this problem was met.

Using the agricultural survey as a basis, the names of all owners of threshing and harvesting machinery, both reapers and binders, were secured. A personal visit was then paid to each owner of a threshing machine and also to the owners of harvesting machines in those towns where but a few machines were present. The idea in visiting the threshing machine owners was to ascertain exactly the condition of

each machine, its capacity, whether the owner was supplied with power to run it, and most important of all, how much work he could and would do outside of his own, and in a general way what territory he could serve. The available facts with regard to grain acreage and available machinery were brought before local groups for action. In almost every community where it was needed, some satisfactory arrangement to provide for reaping and threshing was made.

Work similar to this was carried on thruout the five counties in which the agricultural census was taken. In Hartford County the problem was taken up with the war bureaus. In Tolland and New Haven Counties no very serious farm machinery problems were found to exist. In Windham County, altho an agricultural survey had not been taken, much was done by the county agent to meet this problem. A very interesting cooperative association was formed in Plainfield for the purpose of buying and owning farm machinery and exchanging labor.

FIELD TESTS AND DEMONSTRATIONS.

Field tests and demonstrations to prove the value of certain field methods and practices were consuming a considerable portion of the time of county agents before the outbreak of the war.

PRUNING AND SPRAYING DEMONSTRATIONS—Eighty demonstrations of pruning and spraying orchards with an attendance of 1233 farmers were held in 1916; and thirty-two demonstrations with an attendance of 353 farmers in 1917. Very few demonstrations were held this year. The falling off has been due to two causes: (1) the inroads of war work on the time of agents; and (2) a growing realization that the failure of farmers to prune and spray has been a result of deeper causes than a lack of knowledge in pruning and spraying. It is becoming increasingly apparent that before apples can be made a successful money crop, the farmer must find a way to take care of his spraying without interfering with more important work, that the grading and marketing problems must be solved, and that it is of little value to the farmer to solve any of these problems unless he is able to work out the solution to them all. The success of the Washington Fruit Growers' Association, in which the cooperative association itself does the packing and marketing for the farmers, and in which the spraying is done by high-power sprayers owned cooperatively, is worthy of consideration in many other communities as a possible solution to this problem. Assistance by county agents to communities in organizing associations of this general type, in training sprayers and packers and in helping managers on their marketing problems will undoubtedly in the future lead the way to spraying and pruning demonstrations such as have been given in the past.

TRACTOR DEMONSTRATIONS—The difficulty of securing sufficient labor has created an intense interest among farmers in the

tractor as a means of increasing production per unit of labor. To give the farmers an opportunity to observe various tractors in operation to compare their behavior and adaptability to conditions and various kinds of work the county agents have conducted a number of tractor demonstrations during the summer of 1918.

The following table shows the number of such demonstrations and the attendance by counties:

	No. Dem.	Attend.
Fairfield County	2	600
Hartford County	1	800
Litchfield County	1	100
New Haven County	2	1700
New London County	1	80
Tolland County	1	40
Windham County	1	20
	9	3290

DEMONSTRATION FARMS—Seven demonstration farms have been systematically followed up by the Assistant County Agent in New London County for nearly two years. Dairy records and farm accounts have been maintained. On the farms, field tests and demonstrations have been carried out. The Assistant County Agent has spent one night monthly on each of these farms. Altho the work was done for demonstration purposes, part of the expense was borne by the co-operating farmers. Some of the demonstration material made available as a result of this work has been brought to the attention of farmers thru the press and thru exhibits at the fairs. Similar work is being done in Windham County.

WORK WITH FARM CROPS—Tests and demonstrations have been conducted for the purpose of introducing productive varieties of corn, oats and soybeans. They have also been carried on to demonstrate the best methods of growing clover, alfalfa and soybeans, and their value as a source of protein in the ration. In 1917, a series of corn variety tests and a considerable number of corn and soybean silage demonstrations were carried out in co-operation with the Connecticut and Storrs Experiment Stations. In 1918, nineteen variety tests were conducted. Field measurements on these tests were made by the County Agents and various determinations requiring special laboratory facilities were made by the Experiment Stations. The results of these demonstrations have been brought to the attention of the public thru the press, thru circular letters, at meetings and at the various fair exhibits. The results of the field tests and demonstrations can be obtained from the report of the Extension Agronomist. The following table shows the number of demonstrations carried on in each county during 1917.

1917

	Fairfield	Hartford	Litchfield	Middlesex	New Haven	New London	Tolland	Windham
Soybean and corn	27	3	8	6	4	35		
Soybean	14	8		12	10	10		
Alfalfa	13						1	
Pruning	1		3	1	1	7	14	5
Corn Variety							1	
Poultry Demon.	13	9	13	12	19	14	1	17
Lime and Clover			1					
Oat Varieties								
Potato Spraying		2			5	1		
Hay								
Hog Cholera	2		3					

BOYS' AND GIRLS' WORK—Some of the County Agents and all of the Assistant County Agents have carried on projects in Junior work. In 1917 this took the form of Boys' and Girls' Club work, and in 1918, of organization and supervision of Junior Food Army activities. In Middlesex, Tolland and Windham counties the Assistant County Agents acted as County Leaders of this work up to July, 1918. The results of their activities are fully described in the report of the State Leader of Boys' and Girls' Clubs.

DAIRYING—Since practically all farmers in Connecticut outside of specialized market garden, tobacco, seed and fruit areas, carry on diversified farming in which dairy constitutes the main source of income, it was upon dairy problems that the efforts of County Agents were largely centered before the war. The County Agents have devoted their efforts to better home grown roughage, better feeding, dairy records, farm accounts, and the introduction of pure-bred stock of real merit.

COW-TEST ASSOCIATIONS—In 1916, there were nine cow-test associations with which the county agents were closely connected. These associations comprised about 180 herds. Three were in Litchfield, two in Hartford, and one each in New Haven, New London, Fairfield and Windham counties. Inadequate follow-up work and supervision and the inability to secure testers after the outbreak of the war have brought about the dissolution of all these associations. The cow-test association rendered valuable service not only to its members, but to farmers generally because of the data which it offered for demonstrating the value of dairy records and better methods of feeding.

DAIRY RECORDS—The keeping and use of dairy records as a guide to feeding and to the selection of stock have been advocated by County Agents at all times. The milk of 886 cows was tested for farmers by County Agents during 1917 and rations were figured for 89 herds.

BETTER HOME-GROWN ROUGHAGE—The soybean, alfalfa and corn variety tests and demonstrations discussed under the heading Field Tests and Demonstrations describes the work done by the Farm Bureaus in promoting the growth of better roughage.

BETTER STOCK—Valuable work has been done in increasing interest in better stock and in helping farmers to select foundation stock for their herds. County Agents assisted farmers in purchasing forty-five purebred bulls and fifty-one purebred cows and heifers in 1917. This work has continued during the present year. In Litchfield County, a county-wide bull campaign was carried on in which all the bulls in the county were inventoried, meetings held in every dairy town, and an attempt made to reach personally every owner of a poor bull. In Middlesex County, efforts have been successfully made to establish centers of purebred stock production. Results at Haddam Neck, where a few farmers are growing Guernseys, have been gratifying. In Tolland County, the Farm Bureau has been instrumental in the establishment of a County Jersey Breeders' Association of much promise.

PERSONAL WORK—Personal assistance rendered farmers at their request has constituted a very important part of the work of County Agents during the past two years. This assistance has been rendered thru calls made by the farmer at the farm bureau office, thru telephone calls, letters, or in visits of the County Agent to the farm.

COUNTY AGENT STATISTICAL REPORT

OCTOBER 1, 1917

—to—

SEPTEMBER 30, 1918

County	Days in Office	Days in Field	Letters Written	Office Calls	Farm Visits	Demonstrations Visited	Meetings at Demonstrations	Attendance	Other Meetings Held	Attendance
Fairfield	*229½	*207	* 548	* 190	* 385	* 8	* 4	* 774	51	1569
Hartford	*307½	*217½	*2120	*2253	* 201	7	8	1819	*105	* 6079
Litchfield	77	203	722	566	567	73	...	.....	45	2366
Middlesex	*224	*470½	* 597	*1573	*1519	*15	*11	* 187	*105	* 3855
New Haven	*170	*368	*1661	*1587	* 776	*15	*13	*1664	*203	*11861
New London	*199	*347½	*1289	* 443	* 628	47	12	76	*209	6184
Tolland	*177½	*339½	*2168	*1122	* 428	*14	*10	* 198	*203	10766
Windham	*177½	*309	*1116	* 419	* 237	2	3	45	122	6845

* Two agents at work.

COUNTY AGENT STATISTICAL REPORT

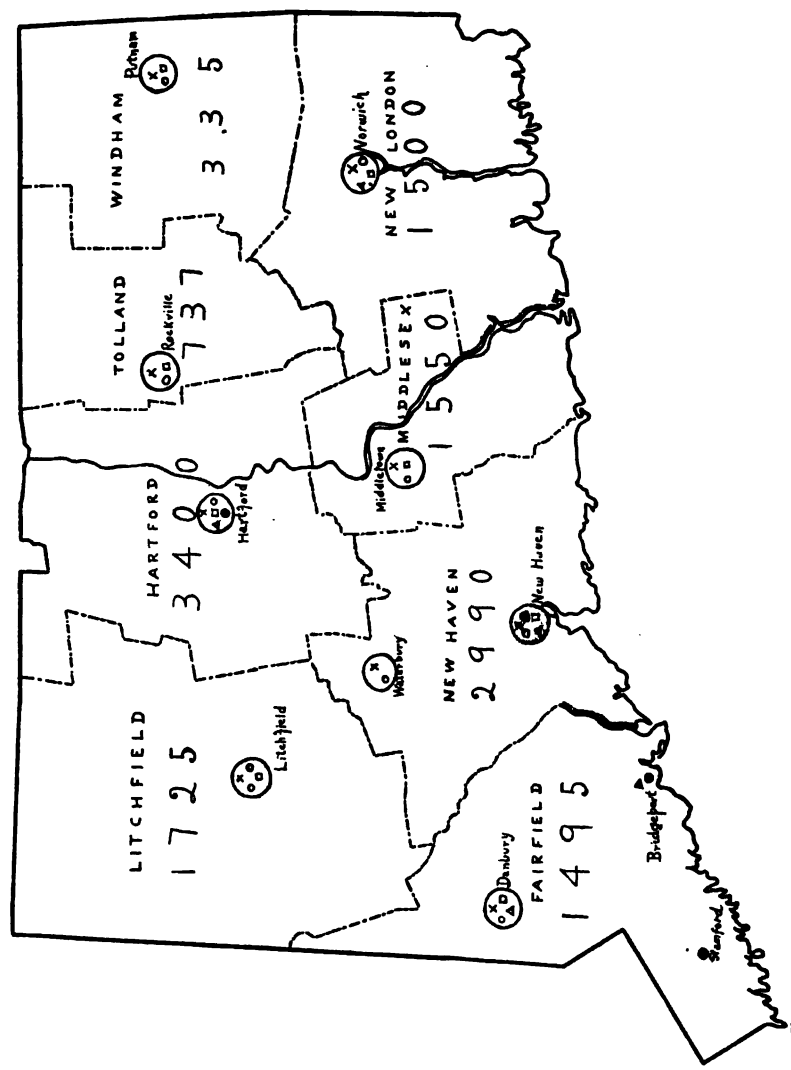
OCTOBER 1, 1916

—to—

SEPTEMBER 30, 1917

County	Days in Office	Days in Field	Letters Written	Office Calls	Farm Visits	Demonstrations Visited	Meetings at Demonstrations	Attendance	Other Meetings Held	Attendance
Fairfield	69¼	152¾	1209	123	243	25	2	72	78	2309
Hartford	81	154¾	846	449	298	19	9	243	103	3634
Litchfield	84½	215	755	650	408	37	19	347	115	4452
Middlesex	*131	*263½	*1344	*787	*1418	* 40	* 19	*663	99	5782
New Haven	110	*264	* 924	*670	* 712	* 36	* 23	*382	*128	*4417
New London	*192	*370½	*1280	650	* 852	*109	*175	*489	*243	*8250
Tolland	* 85½	*163½	955	385	161	7	14	167	*120	*6467
Windham	79	206	1042	555	101	1	4	178	89	2281

* Two agents at work.



Map Showing the Distribution of Farm Bureau Membership in Connecticut and Location of County Workers.

KEY:

Large circle,	Farm Bureau headquarters
Cross,	County Agricultural Agent
Small circle,	Home Demonstration Agent
Heavy dot,	City Emergency Food Agent
Square,	County Club Leader
Triangle,	Assistant County Agent
Heavy triangle,	Special Agent for Food Production in cities

EXTENSION WORK IN HOME ECONOMICS.

Maud E. Hayes, State Leader of Home Demonstration Agents.
M. E. Sprague, Home Economics Director.
Dorothy S. Buckley, Ass't State Leader of Home Demonstration Agents.

*Gladys B. Green, Fairfield County, Danbury
†*Marion E. Dickenson, Fairfield County, Stamford
†*H. Irene Weed, Fairfield County, Bridgeport
*Margaret L. Robinson, Hartford County, Hartford
†*Jennie E. Maxfield, Hartford County, Hartford
†*Bessie M. Reynolds, Hartford County, Hartford
†*Helen R. Hills, Hartford County, Hartford
†*Jeannette E. Metcalfe, Hartford County, New Britain
*Emily R. Bronson, Litchfield County, Litchfield
*Marie Lovsnes, Litchfield County, Litchfield
*Clara E. Ketcham, Middlesex County, Middletown
*Zoe F. Meade, New London County, Norwich
†*Marie A. Nelson, New Haven County, New Haven
†*Mary C. Blodgett, New Haven County, Waterbury
*Margaret A. Costello, Tolland County, Rockville
*Charlotte Embleton, Windham County, Putnam

† City Demonstration Agents
* Supported cooperatively by County Farm Bureaus, U. S. Department of Agriculture, and Connecticut Agricultural College Extension Service.

First Year

For convenience the summary of State Wide Extension work from October 1, 1916, to October, 1917, is divided into two periods:

I. Before war was declared against Germany; October, 1916 to May, 1917.

II. After war was declared against Germany; May, 1917, to October, 1917.

I. First Period

During the first period Extension Work in Home Economics was carried on along the following lines:

A. County Home Demonstration Agent Work

On October 1, 1916, the one Home Demonstration Agent in Connecticut, located in New Haven County, had completed her first month's work. The postion of State Home Demonstration Leader until August, 1917, was merely nominal and her work consisted of visiting the one Home Demonstration Agent at intervals, receiving her reports, advising her about her work, helping her in two extension schools and making a monthly summary of her work for the Washington office. Home Demonstration Agent work with this one worker existed in the state in this manner until June, 1917. Though the beginning was small the first Home Demonstration Agent paved the way for future work. She tried out experiments and was tried out by these experiments. Their value consisted in familiarizing the women of the county with the possibilities of Home Economics work in their communities and the Home Demonstration Agent work was done mostly thru organized groups which met regularly to discuss problems interesting to their

communities, to observe demonstrations given by the Agent and to make plans for improving local conditions e. g. establishment of a school lunch, campaign against flies, etc. Committees were appointed in each town to arrange for meetings, and to decide with the Agent's help the program of such meetings, the degree of cooperation of the agent, etc. While the organization and methods of Home Demonstration work in the state have changed since this pioneer attempt, a good foundation was laid in New Haven County for the development of later work. The following statistics cover the eight months from October to June when Miss Knowlton was the only Home Demonstration Agent at work in the state:

Letters written	482
Bulletins distributed	4032
Articles published in local press	20
Home visits	31
Demonstrations and meetings	144
Attendance	6840

B. State Extension Work

From October, 1916 to May, 1917 the State Extension work was along the following lines:

1. **Supervision** of the New Haven County Home Demonstration Agent as indicated above.

2. **Extension Schools** Arrangements and preparations for these schools were made in the fall. They were carried on after the plans of those held in 1916 when eight Four-Day Extension Schools were given in the state. The 1917 Schools were held as follows:

Date	Place	County	Average No. each session	Greatest No. present	Total
Jan. 2 - 5	N. Canton	Hartford	19	22	152
16 - 19	Essex	Middlesex	31	40	214
23 - 26	Canterbury	Windham	31	40	249
Jan. 30 - Feb. 2	Colchester	New London	11	14	78
Feb. 6 - 9	N. Stonington	New London	19	27	135
13 - 16	Middlebury	New Haven	15	21	104
20 - 23	Cornwall	Litchfield	22	33	178
Mar. 6 - 9	Bethlehem	Litchfield	25	38	282
13 - 16	Ellington	Tolland	40	53	318
					1710

Besides these Four-Day Schools in home making which were held co-ordinately with the agricultural schools, the following two-day schools were held in home making, being the second schools to be given in each community with the exception of the one at South Woodstock:

Date	Place	County	Average No. each session	Largest No.	Total No.
Mar. 19 - 20	Old Saybrook	New London	57	66	229
22 - 23	Brookfield	Fairfield	40	50	161
27 - 28	Woodstock	Windham	13	20	53
29 - 30	Preston City	New London	18	24	71
					514

Total number present in 13 schools, 2224.

C. Miscellaneous

February Plans for exhibit at the Joint Convention of Pomologists and Vegetable Growers. These included

1. Preparation of display of 140 dishes made from fruits and vegetables grown in Connecticut.
2. Vegetarian meat contest.
3. High school demonstrations in preparing fruits and vegetables.

March Attendance at Three Days' Conference of Home Economics Extension workers of the North and East at Boston.

April Attendance at Four Days' Canning School at Amherst, Mass.

II. Second Period

The declaration of war by the United States against Germany crystallized the plans for State Wide Extension Work into plans for definitely promoting food conservation work as the most necessary thing to be done during the summer of 1917.

The two most important phases of the organization of conservation work were as follows:

1. Organization and maintenance of canning schools to train volunteer demonstrators.

2. Appointment of County Home Demonstration Agents to carry on food conservation work.

A. Canning Schools.

Plans for these schools were made in May. They included purchase of equipment, preparation of a canning bulletin (jointly with Committee of Food Supply), organization of schools, program, instructors, etc.

On June 5 the first of a series of seven canning schools was commenced. These schools were conducted each week of June and July, (except the first week of July) with a weekly attendance of about seventy persons and a total attendance of between 450 and 475 women and 20 men. The course covered demonstrations in home and community canning, practice in both, lectures on choice of fruits and vegetables, storage of fruits and vegetables, Boys' and Girls' Club work, bacteriology of canning, methods of demonstration, food conservation, etc., trips over the College buildings and ground were made. Each person in the home canning course canned five jars of products. About 3000 jars were canned in glass, of which all but 600 were sold at cost during the schools, usually to the persons who had canned them.

It was emphasized thruout the course that the schools were for the purpose of training leaders and at the end of each school those in attendance were asked to pledge themselves to carry back to their communities what they had learned by holding demonstrations, and by

personal instruction to individuals and they were urged to consider themselves as bearers of a definite food conservation message to the people of Connecticut.

The visible results of these schools were as follows:

1. 170 canning demonstrations were given in their communities by volunteer leaders who were trained at the college. Many more which were not reported are known to have been given. Information about canning was given by telephone, personal calls, etc., to hundreds of persons by these volunteers.

2. Fifteen community canning centers were established in Connecticut. Practically every center was organized by persons trained at one of the canning schools. Hundreds of volunteer workers were in turn trained in canning methods and the season's output for the fifteen centers was 50,873 jars. The greatest number for one center was 11,500 jars and the least number, 575.

3. Fifty-seven domestic science teachers were trained at a special school held in July. These teachers, in their turn, used the information gained in the teaching of girls' canning classes and later in their regular school classes.

4. The newly appointed County Home Demonstration Agents received training in uniform canning methods and during the summer gave 244 canning demonstrations to 15,000 persons. At least 25,000 persons were reached thru the public demonstrations given by those who attended the canning schools.

5. From the records of home canning in 1917, received from 159 canning school students, the following figures are of interest:

Total number of jars canned,	23,072
Average number per person,	147
Total per cent of spoilage,	1 1/10%

B. Appointment of Home Demonstration Agents.

Increased interest in Food Conservation and a definite desire for carrying on Home Economics work on a county-wide basis led to the appointment of eight county Home Demonstration Agents during the period between May and October. These agents became, upon appointment, regular members of the County Farm Bureau staff and during the summer their principal work was that of holding canning demonstrations in the various communities of their county. The following appointments of Home Demonstration Agents were made:

May	New London County
June	Hartford County
	Fairfield County
	Middlesex County
July	Litchfield County
August	New Haven (City)
September	Windham County
	Fairfield County (Cities)

In order to further Food Conservation work the Connecticut Woman Suffrage Association gave $800 to each of the Farm Bureaus of five counties to help pay the expenses of a Home Demonstration Agent.

C. Farm Bureau Conference

A Three Days' Conference was held in August to discuss the question: "What should Connecticut do in the next eight months?" This was the first opportunity for seven Home Demonstration Agents to meet in conference with State-wide Extension workers in Home Economics, County and Town chairmen of Home Economics Committees and to discuss the program for winter work. The twenty women present were divided into committees and a conservation program was worked out which was later adopted in most of its details by the different counties as a working basis for Home Demonstration work.

D. Miscellaneous

In August, six cases of exhibits were planned for two fair circuits illustrating thru material and charts the following topics: The Baby's Food, The Baby's Clothing, The Home Medicine Chest, The School Lunch, Kitchen Conveniences.

STATISTICS OF WORK FOR NINE MONTHS FROM JANUARY 1, 1917, TO OCTOBER 1, 1917.

Four Day Extension Schools	9	
Attendance	1710	
Two Day Extension Schools	4	
Attendance	514	
Demonstrations at Extension Schools	84	
Other Demonstration	14	Total: 145
Canning School Demonstrations and Classes	47	
Committee Meetings attended	27	
Other Meetings attended	25	
Talks before Institutes, etc.	12	
Visits to Home Demonstration Agents	12	
Bulletins prepared	4	
Press Articles	13	

SECOND YEAR—OCTOBER, 1917—OCTOBER, 1918

I. Home Demonstration Agent Work

During the year the Home Demonstration Agent work developed along the following lines:

The passage of the Emergency Appropriation Bill in August, 1917, made possible the appointment of Urban Food Emergency Agents and from October, 1917, to October, 1918, the following appointments were made for both urban and rural work:

County	No. Agents Appointed	No. Agents Resigned	No. active Agents Oct. 1, 1918
Fairfield	3	2	3
Hartford	4	1	4
Litchfield	3	2	2
Middlesex	—	—	1
New Haven	3	1	3
New London	1	2	0
Tolland	1	—	1
Windham	—	—	1
	15	8	15

No. of Home Demonstration Agents in service October 1, 1916		1
No. of Home Demonstration Agents appointed between October 1, 1916 and October 1, 1918		24
	Total	25
No. of Home Demonstration Agents resigned between September, 1917, and October, 1918		10
No. of Home Demonstration Agents in service October 1, 1918		15

Of these seven are in rural work and eight in urban work, with a position in a county vacant temporarily.

The general program of work has been along lines of food conservation whether thru talks and demonstrations or by means of campaigns. Some attention has been paid to problems of the home other than food, such as clothing, household management, etc., but as the dominant interest all over the country has been that of conserving food the emphasis has been placed upon selection, preparation and saving of food in order to release the foods needed for our allies and army.

The methods of reaching a community have varied with the Agent and the county, and may be classified as follows:

1. Farm Bureau meetings in all towns of a county
2. Regular monthly meetings with a definite group
3. Public demonstrations or talks arranged by the town Home Economics Chairman
4. Home visits
5. Extension Schools
6. Girls' Club work either as leader or in co-operation with local leaders
7. Campaigns and extensive work such as Food Fairs, window exhibits, etc.
8. Canning Kitchens and Food Demonstrations Shops
9. Press, posters, and other publicity.

Methods 3, 7 and 8 have been emphasized especially by city workers. The lecture-demonstration has been the usual point of departure but

intensive work with the individual family or the extensive campaign with a definite pledge and follow-up work have seemed more fruitful of results. The following extensive campaigns have been carried on by Home Demonstration Agents in co-operation with their local committees and other agencies:

1. **Hoover Pledge Campaign,** in which the United States Food Administration and State Committee of Food Supply were assisted by Home Demonstration Agents.

2. **County Corn Shows** were carried on as a part of the Agricultural Program in all of the counties and the Home Demonstration Agents were responsible for encouraging exhibits of dishes made from corn, for which prizes were offered, in planning lunches and suppers with corn dishes, and in giving demonstrations in the best methods of using corn. In one county, corn suppers were held in many towns in connection with patriotic rallies, the proceeds being used for some local philanthropy.

3. **Food Fairs** These were arranged for in each county by the Women's Committee of Council of National Defense in co-operation with local agencies and as a rule the Home Demonstration Agent assisted in planning and setting up the food exhibits, in holding demonstrations and in explaining exhibits. The county exhibits served as models for the small town exhibits and the latter were held in many towns of each county. With these the Home Demonstration Agent had more responsibility for success than for the larger fairs. About eighty of these fairs were held in the state.

4. **Household Surveys** In January, Connecticut was asked to share in a War Emergency Food Survey of Household Inventories and Consumption to be conducted in co-operation with local farm bureaus. The Home Demonstration Agent and her local committee did the work of distributing and collecting the surveys with the following results:

Quota for State	775	surveys
Apportioned among the counties according to number of Home Demonstration Agents in the county	50	" per agent

The rural counties were more successful in the campaign than the urban counties, the county which did the best work obtaining 90% of its quota. Three hundred eighty-seven surveys or 50% were returned.

5. **Potato and Wheat Saving Campaign,** a joint campaign carried on by the United States Food Administration and the Extension Service. This was one of the best advertised campaigns put over in the state and the results were far-reaching. The methods used were as follows:

I. **Publicity**—press articles, distribution of recipes, circular letters to town committees and school officials.

II. **Co-operation**

A. **Schools**—pledges signed, posters made, essays written, exhibits prepared, dishes cooked.

B. **Churches, Granges, Clubs**—Exhibits, suppers served, notices read, talks given, demonstrations given.

C. **Business** (Grocers)—Window displays, demonstrations, report of increase in sales, distribution of recipes.

Under these headings the record of a week for one city in using potatoes may be of interest: Co-operation of newspapers, 3197 recipes distributed, pledges signed in 29 schools, 112,953 potatoes eaten and 73,730 slices of bread saved, 100 posters made, 16 demonstrations given, 45 window exhibits, chain stores reported 120% increase in sale of potatoes in one store.

The record of one small town in increasing the use of potatoes to save wheat was as follows:— Every family in the town was visited during the drive, 1000 bulletins distributed, 4-minute talks given in every grade in school, slides put on at the "movies" urging use of potatoes, recipes printed in local papers; leading stores had window exhibits.

Other statistics of the state-wide campaign are

Demonstrations in uses of potatoes	80
Talks	27
Potato suppers	24
Exhibits	about 100

6. **Cottage Cheese Campaign,** in cooperation with the Dairy Division of the United States Department of Agriculture, Miss Eleanor Moss was appointed a rural agent in Dairying from April to October.

In order to have the fullest co-operation of the Home Demonstration Agents with the Agent in Dairying, one of the first things done was to hold two Two-day Extension Schools to teach the Home Demonstration Agents how to make and use cottage cheese. By this means they were able to assist the Federal Agents and to give demonstrations by themselves when needed. Throughout the whole summer there was hearty co-operation in each county and in the state-wide summary of the Cottage Cheese Campaign throughout the Northern and Western States, Connecicut stood first in a greater number of points than any other state. Much individual work was done in the country with farmers, farmers' wives and dealers along the line of improving the type of cheese and in teaching the use of surplus skim milk. The city work emphasized the use of cottage cheese rather than the manufacture and the market supply of cheese and the facilities for making it was investigated in each city where any work was done. The following

statistics of the summer's work do not include the work of the Agents in Dairying:

No. of demonstrations	49
" " talks	24
" " exhibits	
a. food shows	6
b. store windows	24
Press articles	34

Report of increase There was a general report of increase in sales. The supply did not always meet the demand. Several dealers were taught better methods of making cheese.

Cooperation with schools

1. Five schools were taught cottage cheese making and use in classes in cookery.
2. The Hartford High School prepared two exhibits and also made posters.

Statistics of Rural Agent in Dairying

Demonstrations given	118
Attendance	3,500
No. of communities reached	80
No. of individuals taught to make cottage cheese for commercial purposes	12
Gallons of milk used by Agent in Dairying	330*
No. of lbs. of cottage cheese made by Agent in Dairying	500

*one of the results of the campaign is a demand for pound packages of cheese to be eaten as a food rather than for small amounts used for a relish at a meal.

7. **Milk Campaign** The wider use of milk as a food, especially for children, has been a part of the food program in each county and has been emphasized more or less as the need arose. The decided rise in price of milk was an important factor in the planning of a campaign of education as to its value as a food and it was found advisable to arrange a definite campaign in three of the cities with this in view. These campaigns were backed by the Chamber of Commerce, the Board of Health, and the local milk producers and dealers. The details were worked out by the Farm Bureau.

The methods used were press publicity, distribution of recipes and bulletins on milk routes. Moving picture theaters showed slides on the value of milk in child feeding. Window exhibits included a group of children eating their supper of milk dishes, charts, display showing comparative food value of a quart of milk, and a child's meals for a day. Demonstrations were held in stores in various parts of the city.

The results were increased demand for milk in restaurants and on milk routes.

Besides the campaigns, four milk stations were established in New Haven for the sale of skim-milk and one in Hartford for whole milk.

The following statistics cover the work of Home Demonstration Agents in promoting the wider use of milk from May, 1917, to September, 1918:

1.	Number of demonstrations given on uses of milk	52	
2.	Number of talks given on uses of milk (exclusive of demonstrations)	58	
3.	Number of milk exhibits	62	
	(a) at Food Shows	36	
	(b) at Fairs		
	(c) in store windows	26	
4.	Number of milk campaigns	3	
5.	Number of milk stations established	8	
	(a) number of quarts sold daily	140	(average)
	(b) number of glasses sold daily	20	"
6.	Press articles in local papers	69	
7.	Report of increase in sales	All report increase in sales especially in families with children.	
8.	Cooperation of schools	1. Station conducted in New Haven school. 2. Circulars distributed thru schools. 3. Teachers give talks on milk. 4. New Britain prepared window exhibit and supper. 5. Rockville — Domestic Science teacher gave special lesson.	

8. **Canning Campaign** Connecticut accepted as an assignment by the U. S. Department of Agriculture the business of canning 5,000,000 quarts of fruits and vegetables and a State Canning Committee was appointed as a sub-committee of the Food Committee of the State Council of Defense.

The following methods were employed to obtain the desired quota: A state organization to be known as the Connecticut Canning Corps was formed and a State Committee appointed by the Committee of Food Supply was placed in charge. County quotas were apportioned by the state committee.

The Home Demonstration Agents received the enrollment cards and will be able to use them when filed as a basis for other work. Results of the Campaign will not be compiled until December, 1918, but advance statistics show that the rural counties will certainly go "over the top." The chief difficulties in the campaign have been local scarcity of products and the fear of confiscation of products by the U. S. Government due to active German propaganda during the last canning season.

Statistics of Home Demonstration Agents' Work

October, 1917—October, 1918

Home visits	2299
Talks and Demonstrations	1865

II. State Wide Extension Work

As the number of Home Demonstration Agents increased and the work developed, it was necessary to increase the force which supervised Home Economics Extension work and in January, 1918, Miss Dorothy Buckley was appointed an assistant State Leader.

The following statistics indicate a year's work of the State Home Demonstration Leader and eight months' work of the Assistant State Home Demonstration Leader.

	State Leader Oct., 1917—1918	Asst. State Leader Jan.—Oct.	Total
1. Organization and Supervision			
Committee meetings	54	13	67
Visits to Home Demonstration Agents	100	11	111
2. Field Work			
Meetings	53	15	68
Talks	30	33	63
Demonstrations	23	42	65
Training Schools	5	2	7
Extension Schools	2	2	4
Fairs (Days of attendance)	32	33	65
3. Office and Publicity			
Office Conferences	83	28	111
Press articles	3	8	11
Special reports and outlines	5	5	10

Under the head of State-Wide Home Economics Extension work the following lines of work may be classified:

1. Extension Schools
2. Canning Schools
3. Community Canning Kitchens
4. Store Demonstrations
5. Fair Exhibits

1. **Extension Schools** These were conducted along the same lines as the previous year except in regard to the lesson outlines which were all revised to emphasize the food conservation program of the United States. These outlines were sent to Home Demonstration Agents with the request that they be used in any Extension Schools given in their counties. In five Extension Schools the Home Maker's Course was given and in every school but one the State or Assistant State Leader was present to conduct the school or to assist the local Home Demonstration Agent. Probably due to war conditions there was not so great a demand for Extension Schools as in the two previous years and the severe weather kept down the attendance somewhat. Three of the schools may be regarded as very successful, one fairly so, and one was unsuccessful.

2. **Canning Schools** The 1918 Canning Schools were planned to include three lines of work, less attention being given to canning processes and more to home drying and food economy, with special reference to the food values, proper use and cooking of wheat and sugar substitutes. Evidently the 1917 canning schools had spread canning methods and information very widely over the state and there was such small demand for the schools this year that only two were held, the total attendance being about forty persons who, however, were very enthusiastic about the course.

3. **Store Demonstrations** The next state-wide work was to take the canning and food economy course to city people thru the medium of the department store or market. Twenty-four store demonstrations were given in July in Hartford, Meriden, Ansonia and Derby, and many women were reached who would never have attended a regular demonstration. In most cases the stores considered the work very successful and did all they could to help the demonstrators.

4. **Community Canning Kitchens** Statistics of the 1917 Canning Kitchens were not compiled into a report until 1918 and so are given here.

Statistics of Canneries

Number in state	15
Total number cans	50,873
Vegetables canned	83%
Fruit canned	16%
Miscellaneous products	2%
Largest output of one kitchen	11,500
Smallest output	600

Many of these canning plants were continued this year and new ones started, but it is too soon to obtain statistics for 1918 work.

As a result of a questionnaire sent to students in the 1917 Canning Schools the following data in regard to spoilage of their home products is of interest.

Returns from 159 people

Total no. quarts canned	23,072
Average per person	147
Loss by spoilage due to faulty operation or equipment, not to method	257
Insufficient information as to cause of spoilage	97
Total loss 1.1% or	354

5. Fair Exhibits The scope of the Fair Exhibits this year was greatly broadened from that of last year. The exhibits were prepared by the Extension Service in cooperation with the State Council of Defense and the Committee of Food Supply and the State Leader served on the Food Exhibit Committee. The Food Exhibits covered the following lines of food conservation:

1. A War Kitchen illustrating the housekeeper's shelves of substitutes for wheat, sugar, and animal fats was arranged as one exhibit and demonstrations of wheatless and sugarless breads and cakes were given all thru the day at the various fairs.

2. Cereal Exhibit, much of the material being supplied by the Connecticut Agricultural Experiment Station.

3. Sugar Exhibit showing ways of conserving sugar thru use of substitutes.

4. Cottage Cheese and Milk Exhibit where demonstrations were given daily in uses of cottage cheese.

5. A month's rations for War Workers and the weekly ration for a family of five.

6. Canning Kitchen where the steps of the cold pack process of canning were shown and where marmalades and jellies with sugar substitutes were demonstrated.

Photographs were made of every exhibit and descriptive text was compiled to be of use in future exhibits.

Suggestions for small fair exhibits were sent to Home Demonstration Agents and their chief work during September was to plan and set up exhibits at their local fairs, one of the best of these being that of "The Well Fortified Family," showing the wide uses of farm products.

BOYS' AND GIRLS' CLUB WORK

Junior Extension Work

A. J. Brundage, State Club Leader.
Helen Bolan, Assistant State Club Leader.
M. E. Sprague, Girls' Club Leader.

*Harold A. Brundage, County Club Leader, Litchfield County.
*L. M. Johnson, County Club Leader, Fairfield County
*Harold A. Brundage, County Club Leader, Hartford County
*Paul P. Ives, County Club, New Haven County
*Gaylord A. Newton, County Club Leader, Middlesex County (resigned)
*A. W. Greer, County Club Leader, Middlesex County
*A. C. Sheldon, County Club Leader, Tolland County
*P. L. Sanford, County Club Leader, Windham County (resigned)
*Bertha Hallock, County Club Leader, New London County.

*Employed jointly by the United State Department of Agriculture, Connecticut Agricultural College and the County Farm Bureaus.

The extension work of the College and Farm Bureaus is divided into three general types; work with men, work with women, and work with boys and girls. The Junior Extension Division embraces the work done with boys and girls. This work is done mostly with boys and girls who are conducting some home enterprise and are organized into club groups under leadership.

BOYS' AND GIRLS' CLUBS—Boys' and Girls' club work is not a fad but a State and National Institution supported by State and Federal laws as part of the National program for the promotion of agriculture and the improvement of country life.

Club work is an organized system of Extension teaching for young people conducted by means of group meetings, home projects in agriculture and home economics and practical demonstrations in the field and home. It contemplates the organization of young people into groups called clubs for the purpose of definite work under carefully prepared programs and adequate leadership. From the ranks of club work will be recruited many of the rural life leaders of tomorrow. This is borne out by the fact that twenty-five club members have enrolled for or completed courses at the Connecticut Agricultural College although club work has only been organized for five years in Connecticut and the number of club members who have reached college age is very small.

CLUB PROGRAMS—A club's seasonal program includes regular meetings, with discussions and demonstrations, summer field days and club festivals, exhibits and achievement days.

Club meetings are held at least once a month and are divided into three general parts; business, including subject matter discussion,

demonstration related to discussions, and social, including songs, games and contests.

CLUB ORGANIZATION—Each club has a corps of officers who conduct club affairs under the direction of the local leader. The club is in reality a miniature democracy as the club members have a part in building their own program. Club leaders work with and thru club members and not over them.

PURPOSE OF CLUB WORK—It is the purpose of club work to demonstrate that life on the farm and in the home can be made interesting and profitable and to give boys and girls practical training that will make them more useful citizens and enable them to give and get more out of life. This is done thru the ownership of home enterprises, conducted in such a way that a profit results and thru the socializing influence of club meetings. This is one of the best ways to "pull the stingers" out of common toil and put real purpose in the job, thereby developing intelligent, willing workers who get fun out of their work.

TYPES OF CLUBS—During the period which this report covers the clubs which have been organized have been Corn, Potato, Garden. Canning, Home Economics, Food Saving, Sewing, Poultry, Pig, Calf and Sheep Clubs. The Garden, Canning, Home Economics, Poultry and Pig Clubs have been the most popular.

DISSOCIATED CLUB MEMBERS—In the past many juniors have been enrolled to carry out home enterprises who have not been associated with organized clubs. These boys and girls have not had the assistance of local leadership. As might be expected a much smaller percentage of these boys and girls complete their work than those in organized clubs. By completed work is meant the carrying out of the home enterprise, keeping cost accounts of this activity and reporting accomplishment at the end of the season. Some of the boys and girls in this unorganized group, however, have done exceptional work and have taken greater interest in rural life thru the encouragement which they have received.

INSTRUCTIONS—Instructions related to the conduct of home enterprises have been prepared and sent to all boys and girls enrolling for this work. In this way authentic information has been available for many thousands of boys and girls, thus enabling them to better conduct their home work.

LEADERSHIP AND COOPERATION—It is apparent that leadership is essential to the successful conduct of any educational work with juniors or with adults, and this is especially true of club work. Clubs are never organized until local leadership, either volunteer or paid, is provided. Under good leadership often-times one hundred per cent of the club members carry their work thru to completion. It is

thru organized clubs under good leadership that the best work has been done with juniors in Connecticut.

The success of the junior work, as with the adult work, depends entirely upon the cooperation of local people. The boys and girls thruout the State have shown a most responsive attitude toward club work and the response by adults as individuals and groups has not been lacking. The success of the junior work is largely due to the fine spirit of cooperation that has been shown by individuals, school officials, Women's Clubs, Banks, and all extension workers thruout the State.

The Boys' and Girls' club work year naturally divided into crop seasons and as this report extends from October 1, 1916, until September 30, 1918, parts of three years' work must be reported for the most intelligent conception of accomplishment.

1916

During this year 2794 boys and girls were enrolled as club members. Of this number, 979 completed their work. The products resulting from the efforts of these 979 club members were valued at $14,392.00 produced at a profit of $6,385.63. The production of the entire enrollment probably doubled these figures.

1917

The war conditions in this year together with growing interest in Boys' and Girls' club work helped greatly to increase club enrollment, which more than quadrupled. This showed the willingness of the boys and girls of the state to do what was expected of them.

Additional enrollment could not be cared for without additional leadership, which was forthcoming. In April the first county club leader was appointed on full time in Fairfield county. The total number of paid and volunteer leaders increased about in proportion to the enrollment over the previous year. County Club Leaders or Assistant County Agents in charge of the junior work were later appointed in all the other counties.

Considerable time was spent by the club forces choosing exhibits and training judging and demonstration teams for the contests at the Eastern States Exposition. This time was well spent as the winnings at Springfield demonstrated. A much better showing could have been made if it had been possible to take the best products from Connecticut to Springfield.

SUMMARY OF RESULTS IN 1917—The number of club members completing this work increased from 35% of the total enrollment in 1916 to 52.1% in 1917. The products grown or represented by the 6871 club members were valued at $100,503.58 and were produced at a profit of $22,662.20. The value of the total production of all enrolled members was estimated at $200,000.

In June of 1917 it was the misfortune of this department to lose from active service Miss M. E. Sprague, who had given so freely of her time and energy since her entrance into this work in 1914. The war emergency called for a woman of broad vision and forceful personality, who knew Connecticut people and could work with them in the interest of food production and conservation. Miss Sprague more than met these requirements and was placed at the disposal of the State Division of the Federal Food Administration. She was appointed Home Economics director of the state by the Food Administration, in which position she has since effectively served. Miss Helen Bolan was appointed Assistant State Club Leader to continue Miss Sprague's work.

1918

On account of the increased demands made upon the college for work with boys and girls along diverse lines, it seemed wise early in 1918 to extend the activities of the club workers to cover a broader field.

The work done by the Extension Service in conducting demonstrations with boys and girls along production and conservation lines is now classified as Junior Extension Work in Agriculture and Home Economics.

By authority of the State Council of Defense the Connecticut Junior Food Army was organized under a sub-committee of the Connecticut Committee of Food Supply.

The Junior Extension forces of the State were placed at the disposal of this committee to help develop the Junior Food Army Program for 1918.

The State Junior Food Army Committee, after completing plans for developing the work, requested local war bureaus to appoint local chairmen. From this point on, the county club forces cooperated with local chairmen in the development of the work. Boys and girls were enrolled in the 12 projects chosen by the State Committee, and where leadership was available and the local communities desired, clubs were organized.

The club organization plan of previous years was thus used to meet the war emergency. The Junior Food Army included all juniors in the State engaged in production and conservation work who enrolled in this unit. The unorganized members corresponded to the boys and girls of previous years who were not organized, while the organized members were club members in addition to being Junior Food Army members.

All Junior Food Army members received instructions and record books and other supplies from the Farm Bureaus to assist in the conduct of their projects.

Members of the Junior Food Army who complete their work and make a report are to receive an appropriate certificate from the Governor in recognition of their effort.

COOPERATION—The carrying out of the junior food program during 1918 has been a big piece of work and has been possible only thru the cooperation that has been met on every hand.

County Club Leaders in carrying out the plans of the State Junior Committee had the enthusiastic support of the State Chairman of the Junior Food Army Committee, Mrs. Samuel Russell, Jr., the cooperation of the entire Extension and Farm Bureau forces, State Food Committee, school officials of the state, war bureaus, including local Junior Food Army chairmen, local club leaders, Banking interests and many commercial concerns.

Many of the supplies for the Junior Food Army were provided thru the Connecticut Committee of Food Supply, the remainder being supplied by the College and Farm Bureaus.

HIGH POINTS OF THE SEASON'S WORK—There were four high points in the junior food program which were strongly pushed by the State Committee and County Club Leaders. These were, parades, field days, exhibit, and achievement days. It is interesting to note that the number of these "high points" which local communities carried out increased as the season advanced, showing that the Junior Food Army organization developed greater efficiency as the work progressed.

PARADES—Only Junior Food Army members were allowed in parades who had commenced their home work. This had a decided stimulating effect and was instrumental in starting many jobs earlier than they otherwise would have been. The parade also brought to the attention of the adults that there was a Junior Food Army and that they were producing and conserving food. Twenty-two towns in the state held these parades.

FIELD DAYS—Maintaining the interest of all boys and girls during the summer demands an interesting program. In this connection field days were planned and they were very effective in their purpose. They were held in thirty-seven towns of the State.

EXHIBITS—This was the first year a state exhibit has been held for all the junior members.

The premium list was planned early in the spring in order that it might serve as a guide for planning county and local exhibits. As a result six county exhibits and about fifty local exhibits were planned along the same general line.

The standardization of junior premium lists has done much to insure successful local, county and state exhibits.

Exhibits have been composed not only of the products grown and prepared by boys and girls but also have included record books, stories, demonstration and judging team contests.

The state Exhibit was held in connection with the State Fair at Berlin, the State Fair Association offering prizes to the extent of one thousand dollars.

The state exhibit was a pleasing display of the work the boys and girls are doing thruout the state and afforded competition for several hundred boys and girls who had excelled at local and county exhibits.

The state exhibit helped create greater interest in local and county exhibits and did much to stimulate greater effort on the part of boys and girls in food production and conservation. This was a direct outgrowth of the Boys' and Girls' exhibit in connection with the Eastern States Exposition.

DEMONSTRATION AND JUDGING TEAMS—During the present year much of the club leader's time has been given to the training of demonstration and judging teams. These teams have been developed only with organized clubs and have been composed of three club members who have accomplished good work with their home enterprise and who have been trained to demonstrate the methods which they have used to procure their results.

In addition to the demonstration team training much time and effort has been spent in training these team members for judging work. The combining of these types of work does much to insure more successful work.

LEADERSHIP—During the summer of 1918 there have been county club leaders in six counties. In the other two counties assistant county agents have been in charge of the junior work.

Much more paid local leadership has been available for junior production and conservation work in the state during this year than previously, there being fifty-six paid leaders giving part or full time to junior production and conservation work.

Junior work has made a definite contribution to food production and conservation during the past two years when a sufficient supply of food stuffs has meant so much. But what is more important, it has provided useful training to thousands of boys and girls. The junior work has in many instances materially affected the adult work as is shown in the following report of the Home Economics clubs.

HOME ECONOMICS CLUBS—Late in 1917 a new club project, one on war-time cooking, was added to the list of Boys' and Girls' club projects under the name of Junior Home Economics Club. This called for the completion of a course of twelve lessons in cooking and housekeeping. This course was planned to meet the needs of those young people who do not have similar courses in the schools and hence receive practically no systematic training in the preparation and serving of simple dishes. Besides learning how to cook, they also learned what foods should be used during these war times and how to cook them. The club served the dual purpose of teaching and introducing attractive war-time dishes into many homes which were not co-operat-

ing with the Food Administration. As a result, in many cases, the housewives adopted the children's recipes for their own use.

Thru the efforts of the county club leaders and the Home Demonstration Agents and Home Economics directors, groups of juniors interested in carrying on this project were organized into clubs units, an interested adult in the community acting as leader. These clubs met once every week or two at some convenient meeting place, Grange Hall, school, church parlor, or private house. At each meeting one of the lessons was discussed and one of the dishes prepared. After the lessons the members prepared the different dishes in their homes, keeping a record of the work done.

The enrollment of members by counties is as follows:

County	Clubs	Enrollment Club	Enrollment J. F. A.
Litchfield	18	574	718
Fairfield	17	325	655
New Haven	13	158	681
Hartford	21	464	1018
Middlesex	31	221	378
Tolland	4	36	127
Windham	6	61	102
New London	17	335	554

In addition to club meetings and home work many of these clubs held exhibitions to show their accomplishments and to create greater interest in war-time cooking. Some clubs had demonstration teams which gave public demonstrations showing how to make the dishes exhibited.

Because of the interest aroused in food work, a goodly number of these clubs continued as canning clubs during the summer and have made insistent demands for an advanced course in cooking this winter. Accordingly a course has been planned to meet this demand.

Many junior home economics clubs have done considerable community work in addition to their required work such as, canvassing for canning corps census, papering church vestry and purchasing new window curtains, and the purchase of equipment for a church kitchen.

These clubs were organized in many communities where club work was unknown before and thru their success have made the opening for carrying on different club projects. They have taken into the homes the use of foods desired by the Food Administration and they have learned to help in the homes and to work together, developing a community spirit. Communities have been awakened to the need of systematic instruction in homemaking work and in some cases, as a result of the Home Economics club work, plans are being made for adding such courses to the school curriculum.

The accompanying tables show many interesting points in connection with junior work.

Table I. gives a general summary of Junior Food Army information for 1918.

The State Junior Food Army Committee desired to enroll 50,000 boys and girls for food production and conservation. The total enrollment, however, did not quite reach this number and was 45,465. Part of these members were organized into 478 clubs, which were looked after by 53 paid and 330 volunteer leaders. Paid leaders were supplied in 39 towns and cities. One hundred and ten of the one hundred and sixty-eight towns enrolled their quota or more of Junior Food Army members, while only eight towns in the state had no enrollment. One hundred and thirty demonstration and judging teams were trained and each team gave several demonstrations.

Table No. II. shows the distribution of clubs by counties and by activities. There were in the state last year 3 Corn Clubs, 14 Potato Clubs, 141 Garden Clubs, 100 Canning Clubs, 1 Food Saving Club, 138 Home Economics Clubs, 32 Poultry Clubs, 29 Pig Clubs, 1 Calf Club, 15 Sewing Clubs and 4 General Agricultural Clubs, making a total of 478 clubs. These clubs were distributed by counties as follows:—

Litchfield 136, Fairfield 120, New Haven 26, Windham 39, New London 28, Hartford 54, Middletown 46, and Tolland 27.

Table III. shows the growth of the junior work over a three year period. The enrollment in 1916 was 2345, in 1917, 13013, and in 1918, 45465. While the organized clubs were, in 1916, 61; 1917, 172; and in 1918, 478.

During this same period the paid leaders increased from 7 in 1916 to 37 in 1917, while there were 56 in 1918.

In the future it is planned that more clubs will be developed on a year-around basis. This will enable more systematic work to be done which will be of greater value to the boys and girls and to the state. Several clubs have already started on such a basis and these clubs promise pleasing results.

Since the origin of Junior Work in Connecticut, about five years ago, there has been no division of the rural work from the urban. The time of club leaders and club supplies have been available for all in the state who could use them advantageously.

Extension work with juniors affords an opportunity to help train thousands of boys and girls in the state for useful activity and demonstrate to the people of the state better methods of agriculture and home practice.

TABLE I. JUNIOR FOOD ARMY 1918.

	Litchfield	Fairfield	New Haven	Hartford	Middlesex	Tolland	Windham	New London	Totals
Quota of Junior Food Army members	2850	11800	15900	11550	1600	1000	1850	3450	50000
Enrollment of Junior Food Army members	4768	8108	15517	7592	2095	1914	1789	3682	45465
Organized Clubs	136	115	28	52	46	27	31	28	463
No. of towns exceeding their quota	19	15	16	17	9	13	7	14	110
No. of towns not attaining their quota	7	8	10	12	6	....	8	7	58
Towns having no enrollment	1	....	4	1	....	....	1	1	8
Parades	3	4	3	3	3	3	2	1	22
Field Days	4	7	12	3	6	2	3	....	37
Exhibits	12	14	20	8	8	10	4	2	78
Dem. and Judging Teams	11	57	9	22	9	9	4	9	130
Paid Leaders	5	11	14	5	9	2	5	2	53
Volunteer	60	147	20	40	6	18	11	28	330
Towns or cities having paid leadership	5	9	9	4	6	1	4	1	39

TABLE II.

ORGANIZED CLUBS BY COUNTIES WITH THEIR MEMBERSHIP 1918.

	Litchfield		Fairfield		New Haven		Hartford		Middlesex		Tolland		Windham		New London		Total	
	C.E.	O.C.	C.E.	O.C.	C.E.	O.C.	C.E.	O.C.	C.E.	O.C.	C.E.	O.C.	C.E.	O.C.	C.E.	O.C.	Enr.	Clb.
Corn	20	2	....	....	9	1	....	....	....	....	....	....	....	....	....	....	29	3
Potato	69	8	81	5	....	....	8	1	....	....	....	....	....	....	....	....	158	14
Garden	1359	42	1275	51	10	1	114	4	110	8	270	14	880	21	....	....	4018	141
Canning	416	26	527	20	71	7	372	22	36	4	70	7	15	2	148	12	1655	100
Food Saving	....	....	19	1	....	....	....	....	....	....	....	....	....	....	....	....	19	1
Home Economics	547	35	330	20	187	13	493	21	228	25	30	3	61	6	297	15	2173	188
Poultry	167	15	84	9	130	3	46	2	22	2	....	....	5	1	....	....	451	32
Pig	57	6	167	9	29	3	55	2	28	5	25	2	8	1	5	1	374	29
Calf	6	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	1
Sewing	....	....	103	5	....	....	12	2	....	....	....	....	57	8	....	....	172	15
General	15	1	....	....	....	....	....	....	12	2	13	1	....	....	....	....	40	4
Totals	2653	136	2586	120	436	28	1100	54	436	46	408	27	1026	39	450	28	9095	478

*Club Enrollment

†Organized Clubs

TABLE III.

GROWTH OF JUNIOR WORK

Club project	1916 Enrollment	1916 Clubs	1916-17 Enrollment	1916-17 Clubs	1917-18 J. F. A. Enr.	1917-18 Club Enr.	1917-18 Clubs Org.
Corn	131	....	86	7	1343	29	3
Potato	115	....	140	8	1959	158	14
Garden	1043	....	11572	105	24833	4018	141
Canning	....	....	152	14	4510	1655	100
Sewing	351	21	344	24	....	172	15
Home Economics	....	....	....	....	4233	2173	138
Food Saving	....	....	....	....	2036	19	1
Poultry	191	5	142	5	3297	451	32
Pig	....	....	420	....	2471	374	29
Calf	....	....	....	....	618	6	1
Sheep	....	....	....	....	165	....	....
General	....	....	....	8	....	40	4
Mother-Daughter	200	10	....	....	....	....	....
Garden and Canning	314	25	....	....	....	....	....
Bread	....	....	107	3	....	....	....
Totals	2345	61	13013	172	45465	9035	478

REPORT ON MARKETING AND FARM CREDITS.

Guy C. Smith—Field Agent in Marketing

Previous to October, 1916, the marketing work done by the Extension Service had been only incidental to other work. At that time an Extension Specialist in Marketing was added to the staff on a half-time basis, the other half of his time being given to the College in teaching Agricultural Economics and Marketing. This arrangement persisted until May, 1917, shortly after the appointment of the Connecticut Committee of Food Supply. At that time the Marketing Specialist was given an office with the Committee of Food Supply in Hartford, which has been maintained ever since. This co-operative relationship has been of great value in increasing and extending the marketing work done in the State. On July first, 1917, co-operative relationships were established with the United States Bureau of Markets by which a part of the salary of the Extension Specialist was paid by the

Bureau of Markets, and valuable assistance made possible from that office. From this time on, the Marketing Specialist was known as Field Agent in Marketing. In October, 1917, at the opening of College, an assistant was employed to take over the teaching work, so that it has been possible since May, 1917, for the Specialist in Marketing to devote all of his time to Extension work.

The following is a summary of the work which has been done during the last biennium:—

DAIRYMEN'S ORGANIZATIONS

During the fall of 1916, the movement among the dairymen all over the United States to organize for the handling of their milk selling problems reached its climax. A great deal of the time of the Field Agent in Marketing was spent in working on the organization plans for milk producers' organizations both within and without the state of Connecticut.

At intervals since that time, three farmers' co-operative milk companies have been organized, one a large milk pasteurizing plant to which a large amount of time has been given by the Marketing Specialist, both in drawing up the original plans and upon problems that have arisen since the organization was established. Another company was formed for the purpose of buying out a local creamery to be used as a milk assembling and shipping center. A third company was organized for the purpose of providing a plant and equipment for the retail distribution of milk in one of the large cities just outside of the State. As a result of health regulations promulgated by the United States Public Health Service. it became necessary to provide pasteurizing plants in two Connecticut cities, and work was undertaken looking toward the formation of a farmers' co-operative company in each of these cities for the purpose of providing and equipping milk pasteurizing plants. The work had progressed to a point where a large sum of money had been subscribed by farmers to the stock of these organizations when the close of the war caused the United States Public Health Service to rescind its regulations. The formation of the two companies referred to was, therefore, dropped.

CO-OPERATIVE BUYING ORGANIZATIONS

There are in Connecticut at the present time twelve organizations of farmers, formed for the purpose of buying supplies co-operatively, mainly dairy feeds and fertilizers. The majority of these have been organized within the last two years. Many other farmers' co-operative organizations, formed primarily to perform other functions, are also buying supplies. In all, nearly twenty-five farmers' organizations in the State are buying supplies on a co-operative basis. For the last two years, these organizations have been almost uniformly successful, but it is only fair to say in passing that a part of this success has been due to the fact that they have been buying on an almost constantly rising market.

TOBACCO ORGANIZATIONS

During the spring and summer of 1917, a number of meetings were held among the tobacco growers of the Connecticut valley to discuss the desirability of organizing to pool and co-operatively sell their crops. The final outcome has been that in three towns in Hartford County and in one section in Litchfield County, four tobacco-selling organizations have been formed. Peculiar conditions in the tobacco market in the fall of 1918 have caused many farmers to hold their crops of tobacco, and the organizations are making plans for either buying or leasing and operating tobacco warehouses. Several other towns, at the present time, are considering seriously the formation of similar organizations, and the Field Agent in Marketing has addressed a number of meetings of tobacco growers in Massachusetts where the growers are considering the same step. If these organizations carry out successfully the purposes for which they were formed, they will handle a volume of business amounting to more than two million dollars a year on their present scale.

FRUIT ORGANIZATIONS

The Washington Fruit Growers' Association, formed about four years ago, has demonstrated so successfully the value of that method in handling apples that an effort has been made to spread this information to other parts of the State where somewhat similar conditions exist, and plans are already under way for the formation of other organizations of this type.

MARKET GARDENERS' ASSOCIATIONS

There have been formed in the last two years, two new associations of market gardeners, one at Waterbury and one at New Haven. This brings the total of these associations in the State up to five. While these organizations are not formed exclusively for business purposes, they have been very active in attempting to improve the conditions surrounding the handling of market garden produce. Most of them have co-operated with the Field Agent in Marketing in establishing a Market Reporting Service on fruits and vegetables, which is described below.

MARKET NEWS SERVICE

Undoubtedly, one of the greatest needs among the farmers in this State for the successful marketing of their produce is more complete and regular information regarding the markets which are available to them as an outlet for their produce. An opportunity was found for co-operating with the United States Bureau of Markets in establishing a service which would provide such information. In the latter part of the summer of 1917, the Bridgeport Fruit and Vegetable Association agreed to try out this plan. A man was employed to study

and report daily the condition of the Bridgeport market. His reports were published in the daily papers of that city, advising consumers regarding the products which it was timely to purchase, and also acquainted the growers with the amount of various kinds of products which were being brought to the market daily, and the prices which farmers were receiving for it. The expense in this instance was borne jointly by the Bridgeport Fruit and Vegetable Association and the Connecticut Committee of Food Supply. The Bridgeport Chamber of Commerce rendered substantial assistance in the form of office space and clerical service. So successful did this work prove to be that in the summer of 1918, it was established in the four largest markets of the State, Hartford, New Haven, Bridgeport and Waterbury. During 1918, the salaries of the four market reporters were paid by the United States Bureau of Markets. The other expenses of the service were paid by the local market gardeners' associations, assisted in Bridgeport by the Chamber of Commerce, in New Haven and Waterbury by the New Haven County Farm Bureau and in Hartford by the Connecticut Committee of Food Supply. That this service has been a valuable one to the farmers of the State, there is little doubt. It has been of value not only to the men who were patronizing these markets more or less regularly, but to other farmers scattered over the State, to whom the reports have been mailed free of charge. Recently these reports have extended the service by reporting marketing conditions on eggs, as well as fruits and vegetables. Letters are at hand from a large number of farmers commending the service, and numerous requests have been received that it be extended to other markets and other products thus far reported.

CITY PUBLIC MARKETS

The four largest cities in the State are all working on plans for providing better public market facilities than exist at the present time. To these market places farmers haul their fruit and vegetables to be sold to hucksters and other dealers. It is important that these markets be properly located with respect to certain other agencies such as wholesale houses and terminal facilities. The Field Agent in Marketing has conferred with the local authorities in all of these cities with respect to the problem.

RURAL CREDIT

Under the law which established the Federal Farm Loan System, it became necessary for farmers desiring to avail themselves of the facilities offered by the Federal Land Banks to organize into local groups known as National Farm Loan Associations. Owing to the limited staff which the Federal Land Bank of Springfield had during 1916, the Field Agent in Marketing arranged to assist groups of farmers in Connecticut desiring to borrow from that institution to form the

necessary organizatons. Six such organizations were formed under his direction. By that time the Land Bank was able to supply organizers for this work, and since that time it has been taken care of by them.

One of the needs of farmers has been for better facilities in the matter of securing short term loans. In order to promote this work, the Field Agent in Marketing submitted a plan which was endorsed by the Executive Committee of the Connecticut Bankers' Association and the Connecticut State Council of Defense whereby farmers and bankers were supplied with copies of an "Agrciultural Credit Statement," to be used as applications to banks for short term loans. It is recognized that an application for a loan in the form of such a credit statement is a most businesslike kind of application, and enables the banker to determine much more satisfactorily the applicant's credit standing than he is ordinarily able to do. Twenty-two banks have adopted this credit statement for their use, and have been supplied with copies of it. A number of them have commented very favorably upon their experience in its use. Interest in this work has extended to a number of other states. The New Hampshire College co-operating with the New Hampshire Bankers' Association has adopted the program used in Connecticut, including the credit statement and a little bulletin written by the Field Agent in Marketing, entitled, "Short Term Farm Loans in Connecticut." Several banks in neighboring states have adopted this credit statement, and two or three western states are also making plans to carry on similar work.

PLANS FOR FUTURE WORK

The Market News Reporting Service described above has seemed to fill so valuable a place that plans are under way for extending the service to cover several of the smaller markets in the State, in addition to the four larger ones now being reported. It is expected that these reports will cover a number of other kinds of farm products in addition to the fruits and vegetables and eggs now being reported. This service should be of increasing value to the farmers and the consuming public, as it is designed to give the information to both of them as to market conditions. It is hoped that next season it will be possible for anyone near a market to get the reports not only of their nearest market, but on several others of their nearby markets, in order that they may have a choice of shifting from one to the other, as conditions may seem to warrant. It is also planned to make it possible for farmers by using the telephone to keep in closer touch with the market reporter than has been generally true before.

The year of 1918 has been a most notable one in the history of farmers' co-operative organizations. This is true in other states as well as in Connecticut. There is little doubt that the successful experience of such organizations warrants a still further increase in their

number, and every effort will be made to assist in the organization of groups for either buying or selling where it can be done on a thoroughly sound basis. Reference has been made to the fact that the success of co-operative buying organizations during the last two years has probably been due in some measure to a generally rising market. It is, perhaps, not out of place here to call attention to the fact that with the readjustments likely to come in the near future, the tendency of the market will be somewhat more uncertain than it has been, and there is a question whether these organizations will be able to operate with such uniform success on a fluctuating or declining market. Great caution will need to be exercised in the formation of many more such buying associations.

During the last two years a number of Massachusetts cities have experimented with so-called community markets where farmers might haul their produce to sell it retail to consumers. It is safe to say that in most instances those markets have not entirely passed the experimental stage. It is likely that under certain conditions some of our Connecticut cities would profit by such markets, but the difficulties of carrying them on with success are sufficiently great to warrant their establishment being made only after careful survey of local conditions.

This and other work which will be undertaken must be dictated by the needs in the State, and cannot be definitely laid out at this time.

FARM MANAGEMENT WORK

B. A. McDonald, Assistant Farm Management Demonstrator.

The purpose of Farm Management Extension work is to assist in bringing about such changes in the general organization and methods of the farms of the state as are required to enable them to remain economically successful, and to compete successfully with farms in other sections. Obviously such work divides itself into two parts:

(1) To determine, principally from the experience of successful and unsuccessful farmers, what sorts of farm management are most advisable;

(2) To carry these conclusions to as many as possible of the farmers of the state as effectively as possible.

A report can detail the methods used; it cannot hope at this time to estimate the results obtained.

AREA SURVEY WORK—One method of attempting to draw conclusions from the experience of farmers is to obtain the facts regarding the farm business of forty or fifty men living within a restricted area. The more successful farms are then grouped together and the agricultural practices and the general organization of the farm business on those which are proving most profitable to their owners are compared with those on the less remunerative farms. Practically without exception, it is found that there are certain methods and

types of organization used by those men whose farms are paying the best that are not used by the others. It is usually possible to draw several conclusions from such a study as to what conditions are essential to success on farms of the sort and in the sections studied. Four such area surveys have been carried on during the past two years, each survey being repeated a second year, in order to eliminate the danger that the results may be unsound because of abnormal conditions prevailing during one year only. The conclusions arrived at are carried back to the men from whom the facts are obtained, with recommendations in regard to their particular farms. They are also used for work thruout the state, wherever farming conditions are similar to those in the section studied. One hundred and seventy farms have been included in these area surveys.

STUDY OF POULTRY FARMS—A study similar to the above has been made of forty-two specialized poultry farms scattered over the state. In making this study, the Extension Poultry Specialist and the County Agents cooperated. Conclusions as to the conditions existing on successful poultry farms and presumably essential to the success of such farms were arrived at and issued in a report which was published as an Extension bulletin entitled "Poultry Farm Management."

STUDY OF THE COST OF MILK PRODUCTION—Acting on the request of the Food Committee of the State Council of Defense, the Farm Management Department assisted the State College Dairy Department in making a study of 206 Dairy farms in all parts of the state to determine as nearly as possible, the actual cost of milk production in Connecticut. The results obtained were adopted by the New England Regional Milk Board as the best basis at their command for determining a fair price for milk in the Boston market. Incidentally, this survey has made very evident the fact that there were certain practices common to the farms which were producing milk at the lowest cost. A bulletin was issued giving the results of the survey and outlining the practices that prevailed on these more successful dairy farms. As a further result of the survey, certain farmers requested assistance in keeping more accurate accounts of their farm dairy enterprises. Accounting systems have been worked out with twenty-five such men. In New London County very accurate detailed dairy cost accounts have been kept on seven farms. The results have been summarized and published.

The general agricultural program of the state has been founded upon the results of these and other farm management studies. It is not probable that a sound agricultural program can be built up on any other basis than that of a study of how practices actually do work out under the management of our farmers under our real farm conditions.

DEMONSTRATION FARMS—As a means of demonstrating how some of the more general but more difficult problems of farm management may be met, three demonstration farms have been selected and carried on under the supervision of the county agents with the cooperation of the Farm Management Department and the farm owners. The problems arising on these farms and the methods taken in meeting them have been brought to the attention of other farmers thru published reports and thru visits made on farmers' field trips. Four hundred copies of a report of the farm accounts on one of these farms for the last three years have been printed and distributed to enquirers.

CAMPAIGN FOR FARM ACCOUNTS—One special campaign for the keeping of simple but effective farm accounts was carried on in Litchfield County in cooperation with the Litchfield County Farm Bureau. During this campaign twenty meetings were held in eighteen towns with a total attendance of 469 farmers. Seventy-two farmers opened accounts. They were assisted so far as possible in getting started with the work and at the end of the year in summarizing their figures and in drawing conclusions from them in regard to wise changes in their farm organization. It has been found that in many cases the keeping of such accounts is most stimulating to the farmer, that, when well planned, they give him valuable information that he is not likely to obtain in any other way, and that they are also of value to neighbors who learn of the conclusions reached and readjustments made.

Two types of account books are used to meet the needs and preferences of various farmers. One of them has a supplement designed to give a very concrete and exact statement of the farmers' present worth. The purpose of this is to assist him in establishing credit upon which to borrow money. This supplement was put in in cooperation with the Economics Department of the Extension Service, which has done special work on farm credits and has cooperated with several banks in working out a farm credit system. Account books have been distributed to many farmers in the state. Just as far as possible they are followed up with personal assistance in order to make sure that the full value is obtained from them.

Conditions in farming are constantly changing, the changes going on with particular rapidity during war and reconstruction periods. Changes in management must constantly be made to meet these changing conditions if farming is to remain successful. It is the function of farm management studies to appraise these changing conditions in their relation to the agricultural problem, to find in the practice of the farmers who first develop it, the practical and feasible means of making the readjustment in methods to meet the new conditions, to test the method as severely as possible, and, as soon as its value under particular conditions is proved beyond reason-

able doubt, to carry the information to the other men who need and can use it.

Additional methods for keeping abreast of the development, guaging the new needs as they arise, and finding the means of meeting them are being worked out and initiated.

In the past two years farm management conclusions have been presented at special meetings and as part of the programs of many general meetings, besides forming the subject matter of several bulletins and many press articles and circular letters. They have had their greatest influence, however, thru their incorporation in the general agricultural programs of the Extension Service, to which they have been as they must always be, fundamental.

DAIRY EXTENSION WORK

Karl B. Musser, Extension Dairyman.

During the past few years, Connecticut dairying has gone through a critical period. Increasing costs of feed and labor during the year of 1916 threatened the future of the industry. The winter of 1916-17 saw the organization of the milk producers for co-operative selling effected upon a state-wide basis.

The onset of the war brought to dairyman throughout the State a series of new and perplexing difficulties. It has been the object of the Extension work in dairying to attempt to help dairy farmers meet some of the more immediate problems which have grown out of the war. At the same time an effort has been made to continue the general educational work for the development of a more efficient dairy industry on a long-time basis.

DAIRY MILK RECORDS—Three hundred and eleven farmers have been started on daily milk record work. There has been a gradual increase in the number co-operating with the Extension Service. The increased cost of labor and the large number of sheets coming to the office each month for totaling has made necessary a charge for the work heretofore done free. This will probably reduce the number of co-operators seventy-five per cent, but many of them will continue to keep the daily record.

FARM VISITS—The increased demand for Dairy Extension work created a policy which made the work available to more people than heretofore. Many local meetings with small groups have been held, the results of which have been very satisfactory. Three hundred and eleven farm visits were made. The work done in connection with these visits is quite varied and covers almost every phase of dairy farming in its relation to milk production. In certain localities, it has been through somewhat regular farm visits that community spirit and co-operation have been kept growing. In one restricted area, due to this method, the majority of the herds are now headed by good purebred sires.

LECTURES—Institutes, conventions, Extension Schools, etc., are a form of work taking much time and preparation. Three hundred and ninety-eight lectures have been given to nearly eight thousand people. This shows, on the average, a lecture or meeting of some character every other day. One series alone of five meetings saved in as many localities several hundred dollars in feed costs.

FAIRS—Cattle and livestock exhibits at seven fairs have been officially judged by the Extension Dairyman during the past two years, and in addition to this work, eighteen other fairs have been attended, and nineteen judging contests conducted for boys and girls.

The results of the juvenile judging have been successful from the educational standpoint, and satisfactory to the boys and girls. Three hundred dollars has been won by teams and individuals in state and national contests.

DEMONSTRATION HERDS—One of the demonstration herds has shown an increased income in one year, resulting from the recommendations of the Extension Dairyman, of $432 on the dairy alone. This herd was run two years, and the second year was under the supervision of the Extension Dairyman.

A second demonstration herd has not yet terminated its second Year's work. Its value can only be measured at the close of the demonstration period.

A series of seven demonstration farms was supervised during the past year in New London County, and although the one year's work has no special worth in showing benefits from dairy extension work, it does show very interestingly the importance of judicious feeding on the general farm. Six of these seven farms showed from $400 to $2800 labor income, 36% of which was from the dairy herd.

The facts regarding the herd producing milk at the lowest total expense per quart confirm the opinion that nutrients obtained from good roughages are more economical than when derived from other sources. In this case, milk was made for less than five cents per quart. The feed consumed was 1.25 tons of hay, 3 tons of silage, and .75 tons of grain per cow per year. On the other hand, the farm losing money was producing milk at over six cents per quart. This farm fed 8 tons of hay, 4 tons of silage and 1.25 tons of grain per cow per year. Hay, the natural forage crop of Connecticut, properly grown, is the salvation of the dairyman at present grain prices. It has been gratifying to see that dairying, when properly managed, has, in almost every case, paid a profit. This work is being continued in such a way that the results can be secured in succeeding years.

DEMONSTRATION BULLS—During the past two years, three more demonstration purebred bulls have been placed. The results of such work cannot be observed short of three years, as the offspring should milk through at least one lactation period before conclusions can be drawn. The plan first started through loan agreements by the

Dairy Department of the College to encourage the use of bulls whose breeding suggested superior capacity as dairy sires have been extended. Breeders having well-bred young bulls or used sired are encouraged to loan them, upon written agreement, for a period of two or three years. It is unfortunate, indeed, that many remarkable bulls have been sent to the butcher and their value discovered too late.

COW TESTING ASSOCIATIONS—There have been nine cow-testing associations in existence in the State in the past five years. Six of them were in operation at one time, and it is to be regretted that none of them have survived. The reason of suspension of these activities is directly attributive to conditions arising from the war, viz:—(1) increased difficulties in securing satisfactory testers; (2) greatly increased cost of testers' wages, as a result of demands for men in other occupations.

One encouraging feature of the value and adaptability of this work here is shown by the fact that the first association to be organized was also the last to disband. In order to serve their purpose more efficiently than they did in the past, closer supervision than seems possible from one Dairy Extension man should be provided for such organizations in the future.

MILK AND BUTTER SCORING—Eleven quarterly scorings have been held in three years. Sixty different parties have participated, sending in one hundred and twenty-one samples of milk and forty samples of butter.

The average milk score was 81.68, and the average score was 91.17.

Fifty-eight dairies, exhibiting milk for the first time, received an average score 9.45 points lower than twenty-four dairies exhibiting more than once. Nineteen dairies and creameries exhibiting butter for the first time received an average score 7.89 points lower than ten dairies and creameries exhibiting more than once.

Twenty-six samples (milk sold in cans) had an average score of 73.28, seventy-seven samples (sold in bottles) 84.46, and nine samples (sold in both cans and bottles) 76.25.

Most of the rations reported possessed good variety, palatability, bulk and the proper balance.

Samples scored lower on flavor where feed was given at milking time than when no feed was given at milking.

The average bacteria count in fourteen samples of machine-drawn milk was 433,073 bacteria per c. c., as against 61,800 per c. c., average for all samples sent in, both machine and hand drawn. The average sediment score (ten points possible) was 7.3 for the machine-drawn milk, as against 7.79 for all samples.

Sixty-five samples drawn into small-mouth pails showed an average bacteria count of 20,000 per c. c., lower and a smaller amount of sediment than twenty-two samples drawn into open pails.

MILK SURVEY—A survey of the cost of milk production was made in the spring of 1917, the Dairy Department of the College, cooperating with the Farm Bureaus. The major objects of this survey were to determine the cost of producing milk for the year ending April 30, 1917, and for the month of April, 1917. The work done at this time was at the instigation of the Boston Chamber of Commerce, and as a part of the program of the Connecticut Committee of Food Supply. The results showed:—

1. The cost of milk production on 178 representative dairy farms for the year ending April 30, 1917 was 5.53 cents per quart, or $2.57 per hundred pounds.

2. There was an average annual loss per cow for the 178 farms of $18.42.

3. The cost of producing milk on 178 farms for the month of April, 1917, was 6.29 cents per quart, or $2.92 per hundred pounds, with labor at the yearly rates.

4. The twenty-eight highest producing herds produced milk on the average for 2.06 cents per quart, or 96 cents per hundred pounds, below the twenty-five lowest producing herds.

5. The greatest per cent of purebred bulls and milk records were in the twenty-eight herds with the highest producing cows, while the smallest per cent was in the twenty-five lowest producing herds.

6. The twenty-eight highest producing herds showed a profit above the net cost of production of $10.86 per cow per year, while the lowest producing herds showed a loss of $33.75.

7. The costs were obtained from herds producing approximately six hundred pounds per cow per year above the state average.

8. There is no profit in producing milk at 4.87 cents per quart, or $2.26 per hundred pounds, the average price received on 178 farms for the year ending April 30, 1917. With cows producing on the average of 6,825 pounds per year, the dairyman would just about break even.

The findings of this survey were used in thirteen hearings on the cost of milk production of state and national importance.

DAIRY CATTLE CENSUS—Shortly after the entrance of the United States into the war, there arose the cry that dairy cattle were being sacrificed for beef in large numbers, and that the country faced a serious food production problem. An attempt to determine the true situation was promptly made. Twice during the year, in May and December, information was received from over 1500 dairy farms showing the condition of the herds in May. 1916, May, 1917, and December, 1917, with the following results:—

Dates of Census	Cows	Loss or Gain %
May, 1916	10,972	
May, 1917	10,412	minus 5.1
Dec. 1917	10,630	plus 2.0

Dates of Census	Heifers	Loss or Gain %
May, 1916	4,536	
May, 1917	4,890	plus 7.9
Dec. 1917	5,064	plus 3.5

Dates of Census	Total	Loss or Gain %
May, 1916	15,508	
May, 1917	15,302	minus 1.4
Dec. 1917	15,694	plus 2.5

Comparing the December figures with those of May, 1916, the result shows that the cows were 3.1 per cent less in December; the heifers 11.6 per cent more, and that the total number of dairy cattle on these farms over six months of age was 1.2 per cent more. It seems evident then that one time, probably in the spring of 1917, there was a tendency to reduce dairy herds. Those being sold were without doubt, inferior dairy animals, either with defects or easy keepers inclined to store fat. But the steady increase in heifers, will, in the near future, replace these numbers.

CORRESPONDENCE—Twenty-seven hundred letters have been written during the past two years, and although some of these had to do with some routine work, the majority dealt with the practical problems of Connecticut farmers.

PRESS ARTICLES—Thirty press articles on various timely subjects have been issued in the past two years. In addition to these articles, two bulletins have been prepared and published.

SUMMARY OF THE WORK—

Activity	1915	1916	1917	1918
Daily milk records	75	132	148	168
Farm visits	242	312	133	178
Lectures	38	106	109	189
Fair judged	2	3	2	5
Fairs attended	6	5	8	10
Demonstration herds	2	2	2	1
Demonstration bulls	1	2	2	3
Demonstration silos	1	3	0	0
Cow testing associations	6	9	7	1
Milk and butter scoring	0	3	4	4
Letters written	533	1391	1501	1237
Bulletins published	1	0	0	2
Articles written for the press	0	0	9	21
Juvenile judging contests	0	0	13	6
People addressed		5933	3770	4111
Survey	0	0	3	0

The preceding table shows the growth and decline of various phases of dairy extension work. When the diversity of this work is considered, there is undoubted evidence that the time of the Extension Dairyman can not be used in detail work and meet all calls. Therefore, those types of work whose success is dependent upon detailed supervision will not succeed until ample supervision is provided.

NEEDS OF THE WORK—The needs of dairy extension work are funds to provide clerical and detail assistants. In a state in which the dairy industry is so diversified, one man is handicapped in reaching and supervising much of this work.

AGRONOMY EXTENSION WORK

B. G. Southwick—Extension Agronomist

The position of Extension Agronomist was first established May 1, 1917, and this report outlines the accomplishments from then until May 1, 1918. It should be borne in mind that extension work in farm crops has been carried on cooperatively with the Storrs Agricultural Experiment Station. One fourth time was devoted to Station work under the title of Field Agent in Agronomy. This arrangement has allowed the conducting of Station cooperative tests and made available to County Agents the assistance of both the Experiment Stations for analytical work.

Due to the pressure of emergency work caused by the war it was deemed advisable not to attempt starting definite Agronomy projects in the spring of 1917. The work thru the summer, therefore, was largely assisting county agents in work already started and attending to emergency calls made upon the College and Experiment Station. During the entire year the agronomy work has been conducted principally with the various county agricultural agents, consequently in mentioning the year's accomplishments it is very difficult to assign the credit for them. The Agronomist takes little personal credit, except for securing the hearty active cooperation of the county workers and for assisting them in helping farmers with crop production problems.

EXTENSION ACTIVITIES.

Numerous personal visits were made thru the spring and summer to parties producing food crops for the first time. The results of some of this emergency work seem worth mentioning. The "Hatters" of Danbury grew about 125 acres of potatoes in fields scattered around the city. The yields averaged about 130 bushels per acre, which was good considering the poor condition of much of the land. Advice and some supervision was furnished for this work. The Hartford Rubber Co. grew 8 acres of potatoes in accordance with advice furnished and, with rather unfavorable conditions, produced 112 bushels per acre. The Choate School at Wallingford was given

assistance in growing 25 acres of potatoes, also the Taft School at Watertown, which grew beans, potatoes, and corn. Assistance was given to the city of Winsted, which successfully raised 20 acres of potatoes at an average cost of 97 cents per bushel. Consultation was given on several other potato or garden projects.

A considerable acreage of corn and soybeans was grown by farmers for the first time last year. The Extension Agronomist assisted by advising cultural methods and in determining the results obtained. Mention of this will be made in detail in discussing the Experiment Station work. Results from soybeans with corn for silage were variable and the early frost in the fall was a decided setback. Quite a number of farmers about the state are planning to repeat a trial of this combination crop. Failures seemed to be due, first to late planting; second to too thick planting of large corn; third, to few soybeans in proportion to corn; fourth, to failure of the Mammoth Yellow variety to stand up and to make any pods. Several men who thought the crop too much trouble have changed their minds this winter after feeding it and observing the results.

In cooperation with three county agents, four long-time "farm cropping demonstrations" were planned. These are in progress but results are not yet in evidence. Several field meetings were attended and potato spraying demonstrations made. Thru the entire year numerous lectures in crop production have been given in the state.

The Corn Show work has, perhaps, been of most value. In the summer a project was drawn up for holding county shows and during the winter every county agent cooperated in conducting them. The early frost in the fall and the extremely cold weather in midwinter resulted in the most serious seed corn shortage known for years. The Corn Shows, all of which conducted germination tests, served a most useful purpose in emphasizing the poor quality of seed corn. These tests of the germination of 50 ear exhibits furnished the most interesting and instructive feature, and all of the county agents felt well repaid for the time and effort put into them. For the eight shows a total of 183 exhibits of 50 ears each were tested, and 3500 people is a conservative estimate of the total attendance.

These Corn Shows gave an excellent opportunity for conducting food conservation demonstrations, as well as better corn production lectures and object lessons. The agronomist furnished exhibits of the work of both Experiment Stations and assisted in Conducting and judging the shows. Several counties have already decided to hold such exhibits next year, because they believe it an excellent means of promoting the sale and purchase of good seed corn, of getting the interest of farmers in more and better corn production, and of securing favorable publicity for agricultural improvement.

One direct result of the County Corn Show has been the sale of local seed corn within the state to a greater degree than ever before, as well as the shipment of at least six carloads to other states. These shows stimulated interest in seed corn and helped in locating supplies. Because of this preliminary work, C. H. Kyle, seed corn purchasing agent of the United States Department of Agriculture stated that in his opinion Connecticut was better prepared for the seed corn shortage than any other eastern state.

Partly as a result of the corn shows, at least 100 samples of seed corn have been tested for germination by the Experiment Station at New Haven and much publicity given to the necessity of testing all seed corn before planting in 1918. This is true because the corn shows aroused interest in the seed corn situation and brought home to county agents and farmers the immediate need of further action.

During the winter six Extension Schools of four days each, were conducted at which instruction was given regarding increased production of more home grown feeds for live stock. Fitting the dairy and crop production instruction together resulted in much interest and discussion by the farmers who attended. A number of farmers' institutes have been addressed upon the subject of raising more of the dairy feed needed.

One of the most pressing needs at present is increased production of grain, both to reduce the Connecticut farmers' feed bill and to increase the country's production. Considerable work, personally and by meetings and printed articles, has been done to encourage a greater production of small grains for home use. The agent in Litchfield county has been assisted in promoting a special campaign along this line.

As an outgrowth of this effort a survey was conducted in Litchfield county to determine the crop plans of 1918, the stock on hand, the labor saving machinery, and especially the equipment available for handling an increased amount of grain. This survey taken by farmers from their neighbors,. gave an opportunity for discussing the present crop needs and was apparently successful in stimulating more grain growing, for the only town from which figures are now available plans to increase its area of grain about 130% and has arranged to provide adequate threshing equipment.

The State Council of Defense became interested in an agricultural survey and has assisted in making it possible not only in Litchfield county, but up to date in four other counties. The data secured by this survey will be of more use and value to county agents, extension workers and farmers than can at present be estimated. The Extension Agronomist was only one of several interested and instrumental in making this survey possible and successful.

EXPERIMENT STATION WORK.

In the fall of 1916 the Storrs Experiment Station distributed eight bushels of winter wheat seed to eight farmers. This was seed of varieties which had done extra well in the tests at Storrs. During the summer of 1917 the Field Agent visited all of these trials and secured then and later as much information as possible regarding their success. Some trials were sown too late for good results and some had very poor growing conditions. Unknown to the Experiment Station, one variety was infested with "bunt" which spoiled two trials. Only two men can be classed as successful. One with a selection from Dawson's Golden Chaff secured 30 bushels per acre and the other farmer with Jones' Red Wave got 26 bushels per acre where the crop was sown September 22 but only 17 bushels were sown October 24. Both of these men readily sold for seed all the wheat they cared to spare and are continuing to grow these varieties.

In the spring of 1917 a total of 25 bushels of soybeans was furnished by the two Experiment Stations for free distribution to farmers who would grow the crop for seed. In three counties the agricultural agents assisted in distributing it, while the Field Agent handled it alone in four counties.

About 85 farmers received this seed in varying amounts. The state-wide killing frost of September 10 and 11 prevented the production of seed on many fields and damaged the yield on most of the others. Only three or four fields escaped injury and ripened a normal crop. Considering that soybeans was a new crop to most of the men, that planting was done very late in many cases, and that the season was decidedly unfavorable, the project certainly cannot be called a failure for as near as can now be learned about 130 bushels were threshed. All of the cooperators with soybeans to sell have been able to dispose of them at $5 to $6 a bushel. Many of the men who failed last year are interested in trying again and most of the men who harvested a crop expect to continue raising soybeans.

The Experiment Stations have not received much information regarding the yield of the varieties and the encouragement of a crop with excellent possibilities for Connecticut makes this work worth continuing. Consequently, the Experiment Station is again distributing soybeans in the same way this spring, and it is hoped results will be more favorable.

In the fall of 1917 the Field Agent with the cooperation of county agents secured weights of yields and samples of corn alone, and corn and soybeans grown for silage, from eighteen different farms. Analyses were made at New Haven of thirty such samples and records of results have been sent to all county agents concerned.

The chief object of this work was to determine the actual improvement in feeding value secured by growing soybeans with corn for silage. The figures show that when a medium sized variety of corn is grown the soybeans increase its value for silage, that a vari-

ety of soybeans early enough to set well filled pods is to be preferred, and that the yield is not decreased. With very large growing corn, or when planted thickly, soybeans do not thrive. The results secured from this work are of value to farmers, county agents, and the Experiment Station.

In April, 1918, the Storrs Experiment Station sent out to those county agents who were interested two bushels of superior seed oats, one bushel of early oats and one of a late variety. These are to be distributed for comparative purposes and should furnish the state some dependable information regarding the relative desirability of early and late oat varieties. Furthermore, this seed will furnish the growers an opportunity to make a start in growing better oats if they care to keep the seed separate.

It is felt that a combination position of Extension Agronomist and Field Agent for the Experiment Station is a big advantage to county agents and the work in general. It helps to closely connect the work of the Experiment Station with farm practice in the state and makes available the assistance of the Stations in solving some of the pressing farm problems. The Station should benefit as well, by securing results accurately obtained under actual farm conditions.

POULTRY EXTENSION WORK

R. E. Jones, Extension Poultryman.

During the past two years the poultry industry in Connecticut has suffered a very serious set back in the way of decreased flocks. Due to the high price of feed and supplies together with the extreme demand for labor along other lines, many commercial and farm flocks have been considerably decreased or entirely sold out. Under the existing emergency it seemed advisable to conduct all possible work along definite campaign lines. Aside from lines of work already established, types of demonstrations were selected which would yield immediate returns, and all possible publicity was used to reach everyone keeping poultry in all parts of the state.

COOPERATION.

Practically all of the demonstrations and in particular the work conducted as a definite campaign project has been lined up through the farm bureaus.

THE SLACKER HEN CAMPAIGN.

During the fall of 1917 and the fall of 1918 slacker hen campaigns were conducted, covering a period of three months each. Demonstrations were placed on representative farms in communities where there was sufficient interest to insure a reasonable attendance. The entire flock was handled, the comparative value of the different individuals as producers or breeders was discussed, and the slackers

were culled out. The greater part of the culling was actually done by those attending the demonstrations under the direction of the demonstrator. Records were kept on the egg production of the flock for one week previous to, and one week following the demonstration. The result of each demonstration and the saving from marketing the slackers helped greatly in spreading the practice. Poultrymen attending the demonstrations were asked to sign cards stating that they would cull their flocks.

RESULTS OF SELECTION DEMONSTRATIONS.

Year	1917	1918
Number of Demonstrations	84	81
Number of Complete Reports	59	63
Number of Hens Handled	10195	9630
Number of Hens Kept	6044	5898
Number of Hens Rejected	4151	3766
Eggs per day previous to demonstrations	2740	2611
Eggs per day following the demonstrations	2511	2361
Per cent decrease in flocks	40.7	39.0
Per cent decrease in egg production	8.3	9.5
Attendance at demonstrations	1554	1265
Pledge cards signed	552	554
Number of hens pledged to cull	59959	38965

REDUCTION OF POULTRY FEED COST CAMPAIGN.

During the fall of 1918 feed prices became extremely high, and some feeds previously used for poultry were not available. The campaign was organized to demonstrate to both feed dealers and poultrymen the possibility of mixing satisfactory rations from available grains and at the same time reducing the cost by careful selection and home mixing. Rations were worked out at each meeting, together with their cost based on current retail quotations obtained from local dealers. The poultrymen attending the meetings were asked to fill out cards stating whether they used ready mixed, part ready mixed, or home mixed rations together with cost of same. These reports were tabulated at each meeting and the result compared with the cost of the advised rations.

RESULT OF FEED MEETINGS.

Number of Meetings held	18
Number of attendance	603
Number of towns reached	61
Number of dealers visited	115

Kind of Ration Used	No. of Poultrymen Using	No. of Hens Kept	Cost of Feed per month	Cost of hens per month
Ready Mixed	...149	14,257	$4046.35	28.4c
Part R. Mixed	.. 60	6.918	1881.22	27.2c
Home Mixed	113	30,375	7588.39	25.0c
	312	51,550	13515.96	26.2c

Cost of advised ration for same number of hens 11176.41 21.6c

Possible cash saving per month .....$ 2339.55 or 17.3%

PULLET SELECTION CAMPAIGN.

As a means of locating and eliminating the slacker hen before she starts her year of idleness, eight pullet selection demonstrations were conducted last year. In each case the pullets were divided into three groups, good, medium, and culls. The good and medium birds were kept for comparison, and the culls were sold. Out of the eight demonstrations three returned complete reports. At each demonstration the poultrymen attending took active part in the work and culled the flock under the direction of the demonstrator.

RESULT OF PULLET SELECTION DEMONSTRATIONS.

Number of Demonstrations held	8
Number of People attending	169
Number of Pullets handled	1103
Number of Good Pullets Selected	548
Number of Medium Pullets Selected	416
Number of Culled Pullets Selected	139
11 months' egg production good pullets	114
11 months' egg production medium pullets	85

THREE-YEAR SELECTION DEMONSTRATIONS.

These meetings were designed to demonstrate the possibility of increasing egg production through the selection of the breeding stock During the fall of 1916 the breeding stock was carfully selected on five farms. The egg record of the pullets reared during that year from unselected stock was kept to compare with the egg record of the pullets reared from the selected breeders the following year. Out of the five farms, two have kept complete records for two years, the pullets from unselected stock produced an average of 125.6 eggs per hen per year while the pullets from selected stock produced 143.5 eggs per hen per year.

POULTRY FARM MANAGEMENT SURVEY.

As follow up work of the preliminary poultry farm survey taken in 1915 a complete Farm Management Survey with special blanks for additional poultry information was taken. Records were obtained from 42 farms where poultry supplied the greater part of the income. The object of this study was to determine what fundamental principles of management apply to succesful poultry farming and the most practical and efficient means of their control. The work of taking records and working up data was done in cooperation with the Farm Management Department. All farms were compared on their labor income basis, i. e., the amount which the operator can credit to his labor after paying all expenses plus five per cent interest on the total investment. Certain definite factors were found to influence the labor income as shown from the table below. All records were returned by the Extension Poultryman in order that definite problems relative to each farm could be discussed and means of control or improvement suggested. Three press bulletin articles, a reprint, and a report in bulletin form were circulated on this work.

FACTORS THAT MEASURE SUCCESSFUL POULTRY FARMING.

	Average 42 Farms	Averages 10 Successful Farms
Labor Income	$ 752.	$1830.
Total Receipts	3519.	5145.
Total Expenses	2207.	2717.
Acre Tillable	36.	39.
Poultry Crop Acres	2.5	2.8
Poultry Units per Acre	192.	118
Eggs per Hen	97.	124.
Market Egg Receipts per Hen	2.87	3.25
Poultry Receipts per $100 Feed Cost	220.	267.
Poultry Units per Man	709.	899.
Labor Expense per $100 Receipts	23.	21.

AGGLUTINATION TESTS FOR BACILLARY WHITE DIARRHEA.

The Agglutination Test work started in 1914 in cooperation with the Experiment Station, and has been continued. The extent of the work has been somewhat less than during the two previous years due to the decrease in available labor and equipment and the demand for emergency work along other lines. The total number of flocks tested was 52. There were 9254 hens handled, 908, or 9.7 per cent, of which were found to be infected.

EXTENSION SCHOOLS.

In eight Extension Schools regular poultry courses were given, consisting of eight lectures each on the following subjects:

1. Selection and Care of Breeding Stock
2. Incubation and Brooding
3. Care of the Growing Stock
4. Poultry Feeds and Feeding
5. Poultry House Construction
6. Poultry Sanitation and Disease
7. Killing, Packing and Dressing Demonstration
8. Marketing Poultry Products

Farm visits were made in connection with the school, and an attempt was made to analyze local problems.

TEN HEN FLOCK

As one means of reducing the high cost of living an organized movement for poultry in the back yard was started under the name of Ten Hen Clubs. Four cities took up the work, and considerable interest was created. A demonstration ten-hen house was built and exhibited in each city together with cost of construction from local material. Assistance was given in purchasing birds. About 200 flocks were located.

BULLETINS AND PRESS ARTICLES

One report has been written on Poultry Farm Management, Extension Bulletin No. 8. Two circulars have been written, Extension Circular No. 12, Increase and Conserve Poultry Products, and The Ten Hen Flock, published jointly by the Connecticut Agricultural College Extension Service and The Connecticut State Council of Defense Committee of Food Supply. Twenty press bulletin articles have been written, dealing with timely topics and campaigns that were then in progress. Six reprints have been made from press articles for use on campaign work.

LECTURES

A total of 44 Lectures have been given at Institutes, Grange meetings, Poultry meetings, and Chamber of Commerce meetings on varied poultry topics aside from the talks given at demonstrations held in connection with definite campaigns.

CAPONIZING DEMONSTRATIONS

Eight caponizing demonstrations have been given in response to calls that have come in in spite of the fact that no attempt has been made to encourage the practice under existing conditions.

EDUCATIONAL EXHIBITS

Educational exhibits and timely demonstrations on different phases of poultry work have been given at fairs, poultry show and field meetings. These exhibits have reached a large number of people and have been a means of locating demonstrations and local meetings in communities which would not have otherwise been reached. A total of 19 such exhibits have been made.

JUDGING POULTRY SHOWS

It has been the custom for several of the Grange and County Fairs to ask for assistance in judging. Such work has provided an opportunity for getting acquainted with poultrymen and laying a foundation for future work in the community. Ten poultry shows have been judged.

FARM VISITS

Many farm visits have been made in response to calls for personal assistance on such problems as incubation, brooding, feeding, care and management and disease. It has also been necessary to make farm visits to follow up demonstrations and other work. A total of 176 farm visits have been made.

POULTRY QUESTIONNAIRE

During the spring of 1918 a poultry questionnaire was sent out to 450 poultrymen to determine the extent of poultry selling and the decrease in plans for hatching and rearing. From the 450 cards sent out, 289 replies were received representing 95,548 hens. The decrease in flocks over the preceding year was 9.2 per cent, and the decrease in hatching chicks was 27.2 per cent.

SUMMARY

Slacker Hen Demonstrations	165
Poultry Feed Meetings	18
Pullet Selection Demonstrations	8
Three Selection Demonstrations	5
Poultry Farm Management Surveys	42
Flocks tested for Bacillary White Diarrhea	52
Extension Schools	8
Ten Hen Flocks started	200
Bulletins and Circulars issued	8
Press Articles prepared	20
Lectures given	44
Caponizing Demonstrations	8
Educational Exhibits	19
Poultry Shows judged	7
Farms visited	176
Circular Letters	700
Letters to farmers	1250
Attendance at Meetings	15823
Hens reached through Demonstrations	189440

SWINE EXTENSION WORK

May 7, 1918—March 9, 1918—J. A. Simms, Swine Specialist
March 9, 1918—October 1, 1918—D. G. Sullins, Swine Specialist

PLACE OF SWINE IN CONNECTICUT—For many years the swine industry in Connecticut has had to "root" for existence, a fact which holds true for much of New England. Little attention has been given to the care and management of herds and only in exceptional cases has attention been given to improvement in breeding. Present conditions, however, indicate a place here for swine and that the limits of the industry have not been reached. It is true that our grain production is not equal to that of some states and we could not expect to grow swine extensively on every farm but we have on hand and can produce feeds suitable for swine and should make use of them to such an extent as is profitable. Especially should we use in this way such feeds as otherwise might be wasted.

OBJECTS OF SWINE EXTENSION WORK—In taking up swine extension work in this State the prime object has been to stimulate greater interest in this important phase of food production and to encourage the practice of modern methods in such production. During war time it was especially desirable to make use of the pig in conserving food and in utilizing boy and girl labor which otherwise might not have been used profitably or for any good purpose. While adults were taxed almost to the limit with general problems results to be had in working with boys and girls seemed more promising. For that reason special attention has been given to Pig Club work.

ORGANIZING PIG CLUBS—When Pig Club work was begun in this State, May 7, 1917, it was too late in the year to prepare literature and put on a publicity campaign as would ordinarily be done in introducing a new line of work. In order to get the work started, existing organizations were used. Schools and banks were of great value in stimulating interest and in aiding the work. The co-operation of these institutions together with that of the farm bureaus made it possible to get favorable results even though the work was started late and many difficulties had to be overcome. During the year 540 members were enrolled and as a result more than 600 pigs were grown and fattened.

In starting Pig Club work for the second year a leaflet was prepared giving an idea of the nature of the work together with words of inducement to prospective members. A general distribution was made of this leaflet and it was used extensively in connection with lectures at schools, meetings, etc. Supplies of it were furnished county club leaders for use in organization work. To stimulate boys and girls in this work lectures were given at high schools during the winter and teachers were asked to aid in stimulating interest. A short course for Pig Club members and others interested in swine work was given during the latter part of March to stimulate interest in the work and to give members a broader view, also to prepare future local leaders.

AID FROM BANKS AND OTHER ORGANIZATIONS.

BANKS—To help stimulate Pig Club work in the State several banks have co-operated with the swine extension specialist and county club leaders in financing boys and girls who wished to grow pigs and did not have funds with which to begin. Following is a list of the names and addresses of the banks giving aid:

Bank	Address	
First National Bank of Putnam	Putnam,	Conn.
Windsor Trust and Savings Co.	Windsor,	"
Bristol National Bank	Bristol,	"
Plainville Trust Co.	Plainville,	"
Hurlbut National Bank	Winsted,	"
First National Bank of New Haven	New Haven,	"
First National Bank of Wallingford	Wallingford,	"
The Seymour Trust Co.	Seymour,	"
The Orange Trust Co.	Orange,	"
The Danbury National Bank	Danbury,	"
Fidelity Title and Trust Co.	Stamford,	"
South Norwalk Trust Co.	South Norwalk,	"
Fairfield County National Bank	Norwalk,	"
The First Bridgeport Trust Co.	Bridgeport,	"
The Bethel National Bank	Bethel,	"
Stratford Trust Co.	Stratford,	"
Putnam Trust Co.	Greenwich,	"

The Southington Town School Committee, Southington, The Meriden Chamber of Commerce, Meriden and The Naugatuck Metallic and Rubber Shoe Company, Naugatuck gave financial aid to a number of Pig Club members.

OTHER ORGANIZATIONS—In response to a suggestion that Pig Club members grow some forage for their pigs the following companies contributed a sufficient amount of rape seed to furnish each member one-half pound of seed free:

Company	Address
W. E. Barrett Co.	Providence, R. I.
Frank S. Platt Co.	New Haven, Conn.
Apothecaries Hall Co.	Waterbury, "
Jordan Hardware Co.	Willimantic, "

One half-pound package of rape seed was given to each Pig Club member and directions were furnished for growing and grazing it. In many cases it served well in reducing the cost of growing and fattening pigs.

To further stimulate interest in swine work along the line of judging and selecting animals many valuable prizes were offered for exhibits, demonstrations, judging contests, etc. The Sperry and Barnes Company of New Haven contributed $400.00 and the Connecticut State Agricultural Society of Berlin $150.00 for this purpose. The

Poland-China Record Association offered $50.00 and the Duroc-Jersey Record Association $35.00 for exhibits of pigs of the breeds respectively represented by them.

SECURING AND DISTRIBUTING PIGS—Wherever possible Pig Club members were urged to secure their own pigs. In certain sections, though, especially in and near cities, it was deemed advisable to purchase pigs in truck loads and distribute them among boys and girls. In doing this a time was set for the distribution and the boys and girls came to a designated place with their money, baskets, boxes, sacks, wagons, etc. for the pigs. In cases where banks had co-operated only part payment was made at the time of distribution. The distribution served as an advertisement of the work and acted as a stimulant to the boys and girls.

In 1917 it was necessary to go outside of the State for a number of pigs. These were located by writing to county agents in neighboring states for names and addresses of local stock buyers and purchasing through them. The pigs were distributed in a manner similar to that described above. The cost of handling pigs in this way was very high and overhead charges often amounted to as much as fifty per cent. of the original cost. However, the method was satisfactory under existing conditions. All pigs shipped into the State were given the simultaneous treatment for cholera which avoided losses. Some of the pigs obtained locally, however, came from cholera infested places and a few of them died. In 1918 the local supply of pigs was exceptionally good and practically filled the demand. Only a few pigs were purchased outside of the State for Pig Club work.

FOLLOW-UP WORK—Definite projects with methods of procedure were outlined with each county club leader. Such projects stated the parts to be taken by both the swine extension specialist and the county club leader in following up the Pig Club work. For the State as a whole the projects were more or less general in substance but varied slightly to suit county conditions.

A Pig Club Manual giving such information as is often needed by beginners was prepared but financial conditions would not permit publication. It is hoped that this booklet will be ready for use in 1919. To take the place of this manual circular letters on timely subjects were prepared and sent to club members monthly. These letters and other literature for distribution were sent in bulk to the farm bureaus and mailed out from there. The object in sending literature this way has been to keep Pig Club members of the farm bureaus in close touch with each other.

Club meetings and field meetings have been held in the different counties for the purpose of giving suggestions and maintaining interest in the work. Prizes have been offered for efficient work and pigs belonging to Pig Club members have been exhibited at the different county fairs and at the State Fair. To create interest in competition

and to train boys and girls in judging and selecting pigs much time was spent in actual coaching.

GROWTH OF PIG CLUB MEMBERSHIP AND PRESENT ENROLLMENT—Even though the results of last year's work were easily recognized and the enrollment considered good, the results this year show plainly and a considerable leap has been made in the enrollment. The total Pig Club enrollment for the State is 2,506 and the number of pigs grown by these members exceeds 3,000. This shows how popular this phase of work is with Connecticut boys and girls and gives an idea of the value of such work to the State. Following is the Pig Club enrollment by counties:

County	Enrollment
Hartford	564
Fairfield	498
Litchfield	237
Middlesex	96
New Haven	800
New London	102
Tolland	111
Windham	98
Total	2,506

Each Pig Club member has at least one pig, many have two or three and a few have a larger number. In many localities pigs were distributed among boys and girls not enrolled in clubs. This was done in connection with Pig Club work but complete records were not kept.

BUTCHERING AND MARKETING—In a great many cases in 1917 Pig Club members butchered their pigs for home use. In a few sections this amounted to almost 100 per cent. of the members. After butchering, the boys or girl usually had nothing except the record to show that he or she had or had not made a profit. The fact that they did not receive any money for their year's work seemed unfair to them. In order to avoid this dissatisfaction in 1918 emphasis has been placed on the importance of allowing children to enjoy success when they achieve it. To urge home butchering and curing as far as possible parents have been urged to pay children for their pigs and butcher them for home use.

PROJECT WORK WITH ADULTS—No definite project work was done in 1917 with adult swine growers. Work was begun too late in the year to make changes in farm plans. In 1918 some work was planned with adults and carried on co-operatively through the county agricultural agents. Definite projects were outlined for this work, stating in each case the specific kind of work to be done, the object and the duties of those co-operating. These projects were put in the form of written agreements as they met with the approval of parties concerned. Following is a short summary of the results of a forage crop demonstration in co-operation with the New Haven County Agent

and Mr. Carl M. Sharpe in charge of Hayland Farm, Milford, Connecticut, which is intended to give an idea of the project work with adults:

On the fifteenth of May Mr. Sharpe placed fifteen mature Duroc-Jersey sows on one acre of clover, in fair condition, where they were kept until the twentieth of June. During this time they received one pound of middlings each per day. At the end of this period they were shifted to an acre of clover, then to an acre of oats and peas mixed and later to an acre of alfalfa which had been cut the second time. They were kept on these three lots from June 20 until August 25 without any grain at all. The sows were in excellent condition all the while which makes it evident that mature animals can maintain themselves on forage crops alone. The use of a small amount of grain, however, would add variety to the ration and make it possible to graze a crop longer.

This phase of the work has not been pushed to a great extent this year because most farmers had made their plans for the year before this work was undertaken. Plans are being made to outline forage crop rotations for the coming year and to make arrangements for co-operation before next year's work is planned by farmers.

MUNICIPAL PIGGERIES AND GARBAGE FEEDING—A municipal piggery has been organized in New London for the purpose of making use of the city garbage. Aid was given in organizing the piggery and in planning for the feeding. The swine being fed there at present (about 300) were purchased through the Extension Department of the Connecticut Agricultural College. One car load of 218 was purchased in Ohio and the remainder at Boston, Massachusetts and from local farmers. This work seems to be satisfactory and plans are being made for a permanent piggery.

Work similar to the above was done with officers in charge at the Sanitary Hospital No. 16 at New Haven. Arrangements were made there for feeding garbage to pigs but on a much smaller scale than at New London. It is the intention to keep enough swine to consume all garbage from the hospital.

Conferences have been held with representatives from the Board of Health, Street Cleaning Department and Chamber of Commerce at Meriden to stimulate action on garbage feeding there. At present the garbage is being dumped which means a considerable loss as well as a nuisance. The idea of garbage feeding has been accepted favorably and it is probable that steps will be taken next year to establish a piggery at that place.

SWINE GROWERS' ASSOCIATION—In working with swine growers throughout the State a few have expressed a desire to form an organization which might bring together persons interested in the swine industry, so that sales and purchases might be handled to better advantage and enable swine growers to work co-operatively in many other ways toward promoting this industry. Steps are being taken to

organize a State Swine Growers' Association similar to the National Swine Growers' Association.

LIST OF SWINE GROWERS—Effort is being made to secure and maintain a classified list of swine growers in the State. Such a list is to designate the breeds and kinds of swine on hand, for sale and wanted. Each county agent will be furnished a list of the growers in his county and requested to report changing conditions to the Swine Extension Department at the College. Lists of purebred breeders in near-by states will be kept as a source of information to which we may refer when it is necessary to go outside of the State to purchase or sell swine. The recent agricultural survey will be of value in securing a list of swine growers and when the survey is completed the list can be revised to date.

PHOTOGRAPHS AND LANTERN SLIDES—An effort is being made to secure a good collection of photographs representing Pig Club and swine extension work in this State and to prepare a set of slides for use in connection with lectures at various meetings. A good number of photographs have been collected already and slides will be made from them.

MISCELLANEOUS WORK—Considerable time has been spent in preparing general news articles relative to feeding, care and management of swine. Many farm visits have been made to study specific conditions and to offer advice on certain problems. In a number of cases aid has been given in purchasing and selling animals and in providing for hog cholera treatment. Office work consisting of keeping records, preparing circular letters for Pig Club members, planning future work and handling correspondence has taken a good portion of the time.

SHEEP EXTENSION WORK

A. G. Skinner—Extension Sheep Specialist.

The sheep extension work was started in this State on November 1, 1917, the agent spending part time on extension work and the remainder on College Animal Husbandry work. Although considerable interest was being taken in sheep raising last fall, owing to the work done by the Connecticut Sheep Breeders' Association, the general conditions of the sheep industry were very poor. Upon making a study of the situation, it was found that a large part of the trouble was due to disease, such as stomach worms, nodular disease, to lack of knowledge in handling the flock, and to the damage done by dogs.

HELPING THE GROWER

In order to establish the confidence of the farmers in the sheep industry as a basis for constructive work, the plan of procedure was as follows:

1. To visit the flocks and help the farmer overcome the obstacles which he has to meet.

2. To give advice regarding feeding, care, and management of flocks, control of parasites, etc.

3. To carry on demonstration work during the months of March, April, and May in docking, castrating, and shearing of sheep, and the boxing and tying of wool.

4. To aid the farmer in securing pure bred rams to head the flock.

In following this plan, 66 growers were visited and advice was given in each case, relative to handling the flock, feeding, etc. This work gave better results than any other piece of work done. Three farmers had decided to dispose of their flocks; but upon following the suggestions of the sheep specialist, the flocks are now on a paying basis and are to be increased.

The demonstrations were also a success in that they proved the best way to impress upon the farmer that docking, castrating, shearing, and handling the wool properly, means such a great deal in the sheep business. Nine docking, five castrating, and seven shearing demonstrations were held. The farmers were also informed where they could buy paper twine for tying their wool, and instructions were sent out regarding the boxing of wool.

Considerable work has been done in securing pure-bred rams. Some 20 rams have been selected. Some of these were secured from the College flock, and others from outside the State.

In one county, six or eight rams are to be put on a co-operative breeding plan. The College will send rams out on a rental basis of about $10. per year for each ram. The farmers must handle their flocks under the supervision of the County Agent and the Sheep Extension specialist. After two years' service, the rams will be changed to different flocks. This plan will allow the smaller flock owners to have the use of a good ram at a very small cost.

DEMONSTRATION FLOCKS

Demonstration work is being carried on with four representative flocks. The object is—

1. To secure information on the cost of wool and mutton production.

2. To determine the most economical feeds to use.

Plan:—

The farmer makes out a monthly statement of—

Flock—Showing the sheep or wool bought during the month.

Feed—Showing amount, kind, and cost of feed.

Labor—Showing the number of hours and cost of labor spent on flock.

Inventory is taken January 1, 1918, and January 1, 1919. The agent has not had time to visit these flocks as often as they should be visited, but the work is progressing satisfactorily and will be completed in January, 1919.

HANDLING WOOL

The sheep specialist planned to do some work along the line of cooperative handling of wool during the season. The object of this work was to bring about better methods of marketing so that the farmers would realize a higher price for his wool; to demonstrate to the grower the best method of caring for the wool, shearing, boxing, tying, and marketing; to have the wool brought together at several points in the State; to have graders present who would demonstrate the different grades and value of the wool; and to have buyers present who would pay for the wool according to the grade value.

Owing to the Government regulations regarding the disposal of wool, the plans were not carried out in full. The wool was gathered together at one point, however, and part of it was roughly graded and bought. The remainder was consigned to an approved dealer to be valued and offered to the Government. That which was sold brought from 68c to 74c per pound. Returns from consigned wool have not been received. About 18,000 pounds of wool were disposed of at that time, and considerably more has since been sent directly to Boston.

The direct result of the work done on the sale of wool is that the growers realized a satisfactory price for their wool. In 1917 there was a difference of 30 cents per pound for wool by buyers within a radius of fifteen miles. Many farmers have written to express their appreciation of the way their wool was handled.

SHEEP CLUB WORK

The main object in taking up sheep club work was to stimulate interest in sheep production by teaching farm boys and girls to raise sheep cheaply through the use of well-bred sheep, pastures, and grazing crops, utilization of wastes, etc.

Owing to the fact that breeding ewes were high in price, it was found that Sheep Club work could not be carried out according to the plan outlined by the U. S. D. A., i. e., each club member buying from three to four bred ewes.

By cooperation between the County Club Leader and Agricultural Agent, and the First National Bank of New Haven, a great deal of interest was worked up, and sixty lambs were placed in that county.

The plan is as follows:

The bank finances the project by paying cash for the lambs, and accepting a note from the boy or girl, payable in two years.

Each member takes one or two ewe lambs with the idea of carrying the lambs over for breeding purposes.

A contest is held beginning July 15 and ending November 15, each member being credited on the following points:

Greatest daily gain.
Cheapest cost per pound gained.
General condition of lamb.
Best report and story.

Prizes for the contest will be offered by the Connecticut Sheep Breeders' Association, the banks, and other organizations.

Each member will receive instructions for handling the lambs as the season advances. In addition to this, bulletins, etc., will be supplied.

To facilitate breeding, a pure bred ram will be secured, and arrangements will be made with one member to care for the ewes during the breeding season.

Judging from the success of the Club work in New Haven County, it is felt that the work could be increased with good results in the spring of 1919.

EXTENSION SCHOOL WORK

At an extension school, three days were devoted to sheep work.

Six hours of instruction was given to an average attendance of twenty-six.

LIVE STOCK SHORT COURSE

During this short course, three days were devoted entirely to sheep work. Lectures on types and breeds, and care and management of the flock were given, and also some time was devoted to practical work in judging.

GENERAL WORK

In cooperation with the Commissioner of Domestic Animals, some good work has been done in controlling dogs. Any dog found without a tag is reported and the owner is notified. The Commissioner has used his power to the full extent in controlling dogs. With his and other influences it is thought the legislature will pass a satisfactory dog law in 1919.

From the Agricultural census taken in 1918 in five counties, the agent secured the number and kind of sheep kept and the name and address of breeder. This is valuable data as it allows the agent to send information in the form of circular letters to all the sheep raisers. It is expected that in 1919 this survey will cover the entire State.

Much interest has been shown in the sheep industry during the past two months, judging from inquiries received. Many state their desire to go into the business, but hesitate because of the high price of fencing materials and of breeding stock.

SUMMARY REPORT

Approximate number farm calls	81
Approximate number advised	70
Number of lectures given	18
Total attendance	1039
Demonstrations given	16
Conferences attended	30
Letters written	233
Circular letters written	6

ENTOMOLOGY

G. M. Codding, Special Field Agent in Entomology.

In the spring of 1918, through the State Director of Extension Service, a Special Field Agent from the Bureau of Entomology, United State Department of Agriculture, was assigned to the State of Connecticut.

Owing to the need of increased food production, due to the war, not only was there a greater crop planted by the farmers but thousands of families either partly or entirely solved their fresh vegetable problem by having a war garden. With this increase in crops planted, damage by insect pests was brought home in a forcible manner to many who had up to this time thought little and cared less about them.

Press articles on insects and their control have been published in the College Press Bulletin for state-wide publication. Press articles were also written and sent to all papers in the State through the publicity department of the Department of Food Supply, Connecticut State Council of Defense and other articles were published from time to time in local papers when conditions warranted it.

Probably the worst and most injurious insect pest that was dealt with was the pink and green potato aphid which has been unusually abundant during the past two years. Dr. W. E. Britton, the state entomologist, first found the aphid on potato plants growing in New Haven on June 11, 1918 and the writer found specimens in New Haven on June 14, 1918 and in Greenwich, on the 15th. This is notable as it is nearly a month earlier than the aphid ordinarily appears in Connecticut. The outbreak of the potato aphid was widespread and complaints were received and infestations reported from every county in the State. Many inquiries by 'phone and by mail were received from all of the counties and the office was kept busy for several weeks answering them. Toward the end of the season there seemed to be a decided increase in the number of parasites attacking the aphid. In several localities, particularly in Fairfield County, the aphid was destroyed in large numbers by their natural enemies who apparently were gaining the upper hand.

During the early spring, several so-called delayed dormant fruit tree spraying demonstrations were given and a number of orchards

visited. On account of the shortage of labor and the great increase in acreage planted to field crops, this work was not pushed to the same extent it would have been under normal conditions.

Firms which dealt in spray pumps, spray materials, etc., were visited in the spring and suggestions made on what materials would be most in demand. In spite of this, there was a shortage along some lines in several towns before the season ended.

Throughout the growing season, weekly circular letters were written dealing with the various insect pests attacking Connecticut crops. These letters were written in popular form and made as practical as possible and dealt with the subject in a timely manner. They were sent to agricultural workers connected with the State, College and County organizations, to Garden Supervisors, Garden Leaders, and others interested in increased food production, as well as to all Libraries in the State. The weekly letters had a circulation of approximately 500 and in most cases were published in the local papers. The letters not only described the different insect pests but gave proper instruction regarding how the various spray materials should be prepared and applied.

A special circular letter on spraying was sent to all those farmers growing two acres or more of potatoes in the five Counties where the Agricultural Survey was made, instructing them in the proper method of spraying and telling what to spray with and how to keep their crop free from insect pests throughout the season.

Spraying demonstrations were given throughout the State and proved to be one of the best mediums through which the subject could be presented to the actual growers whose crops were being damaged. The spraying demonstrations were well attended and close attention was given to the work. A number of junior teams were trained to give spraying demonstrations and where these teams appeared at Fairs and Field Days they made a deep impression. This phase of the work should be expanded another year.

Farm visits were made and instruction given on individual problems confronting the owner. Representatives of factory gardens were taught how to mix and apply the various sprays. Several factories which had large garden plots were shown the advantage of buying pumps and spray material for the use of their employees. This material was then sold to their employees at cost. Personal calls were made on County Agents, Garden Supervisors and Leaders, their local problems taken up and help given in solving them.

In one locality a ten-day campaign was put through whereby the children and others collected adult potato beetles before the eggs were deposited. Inasmuch as the female is capable of laying an average of 1800 eggs, and under normal conditions the eggs all hatch, the advantages of this work can readily be seen. War savings stamps were given by the local Chamber of Commerce for each quart of beetles turned in, with the result that potato vines, where the beetles had

been collected, were practically free from the ravages of this pest later in the season.

Exhibits, which included Riker Mounts showing the life histories of the various insect pests found in Connecticut, types of spray pumps, spray materials, charts, and photographs of crops sprayed and unsprayed, were shown at all the larger Agricultural Fairs and proved of interest and value to a great many people. A large number of bulletins relative to insect pests and their control were distributed. Posters were placed in prominent places and on bulletin boards throughout the State.

To a great extent the work this year has been experimental but with the knowledge gained from past experience, campaigns which were tried out locally and proved successful will be carried out on a much wider scale in the future. In addition to this, plans are under way to increase the usefulness and enlarge the scope of the work along new lines.

G. M. CODDING,
Special Field Agent,
Bureau of Entomology,
United States Department of Agriculture.

January 8, 1919.

APPOINTMENTS, RESIGNATIONS, TRANSFERS, ETC., IN EXTENSION SERVICE DURING 1917—1918.

EXTENSION SPECIALISTS

Appointments

Helen Bolan, Assistant State Club Leader, July, 1917.
H. B. Price, Assistant in Marketing, October, 1917.
*A. G. Skinner, Extension Sheep Specialist, November, 1917.
Dorothy S. Buckley, Assistant Emergency State Home Demonstration Leader, January, 1918.
D. G. Sullins, Agent in Animal Husbandry (Swine), March, 1918.
*G. M. Codding, Special Agent in Entomology, March, 1918.
*G. P. Coffin, Poultry Husbandman, March, 1918.
†*Eleanor S. Moss, Agent in Dairying (Cottage Cheese work), April, 1918.
W. A. Rhea, Extension Dairyman, July, 1918.
*Lloyd R. Watson, Specialist in Beekeeping, September, 1918.
Henry Dorsey, Extension Agronomist, September, 1918.

*Work first established at this date.
†Temporary appointment.

Transfers

*B. G. Southwick, from Assistant Professor of Agronomy to Extension Agronomist, May, 1917.

M. E. Sprague, from State Leader of Girls' Clubs to Home Economics Director for the Food Administration, May, 1918.

I. G. Davis, from Farm Management Demonstrator to Assistant County Agent Leader, June, 1917.

I. G. Davis, from Assistant County Agent Leader to County Agent Leader, July, 1917.

M. F. Abell, from Instructor in Agronomy to Farm Management Demonstrator, April, 1918.

G. P. Coffin, Poultry Husbandman, transferred to another State, September, 1918.

*Work first established at this date.

Resignations

*J. A. Simms, Agent in Animal Husbandry (Swine), March, 1918.

B. G. Southwick, Extension Agronomist, May, 1918.

*M. F. Abell, Farm Management Demonstrator, June, 1918.

Karl B. Musser, Extension Dairyman, July, 1918.

*Glenn H. Campbell, Agricultural Editor, July, 1918.

*Resigned to enter military service.

COUNTY AGRICULTURAL AGENTS

Appointments

B. W. Ellis, Windham County, November, 1916.

L. F. Harvey, New Haven County, April, 1917.

aR. J. Whitham, New London County, August, 1917.

aA. W. Greer, Middlesex County, August, 1917.

A. B. Cook, New Haven County, September, 1917.

aH. A. Brundage, Fairfield County, September, 1917.

aC. A. Andrews, Windham County, September, 1917.

L. A. Bevan, Fairfield County, October, 1917.

aW. T. Clark, Windham County, November, 1917.

aR. H. Barrett, Hartford County, January, 1918.

aA. C. Sheldon, Tolland County, January, 1918.

aP. L. Sanford, Windham County, May, 1918.

aAssistant County Agents.

Resignations

F. E. Rogers, New Haven County, March, 1917.

W. C. Cook, Hartford County, April, 1917.

aH. J. Tillson, New London County, April, 1917.

S. J. Wright, Fairfield County, July, 1917.

aC. A. Andrews, Windham County, November, 1917.

a*W. T. Clark, Windham County, April, 1918.

a*A. W. Greer, Middlesex County, June, 1918.

*Resigned to enter military service.

aAssistant County Agents.

HOME DEMONSTRATION AGENTS

Appointments

Gladys B. Green, Fairfield County, June, 1917.
Juanita M. Dean, Hartford County, June, 1917.
Nelle J. Campbell, New London County, July, 1917.
Alice B. Foote, Middlesex County, July, 1917.
Josephine B. Leverett, Litchfield County, July, 1917.
Agnes R. Ferguson, New Haven County, August, 1917.
Clara E. Ketcham, Middlesex County, September, 1917.
cAlice L. Thomas, Fairfield County, Stamford, September, 1917.
Charlotte Embleton, Windham County, September, 1917.
cJeannette E. Metcalfe, New Haven County, New Britain, October, 1917.
cJennie E. Maxfield, Hartford County, Hartford, October, 1917.
cMarie A. Nelson, New Haven County, New Haven, October, 1917.
cCity Agents
cChristine Kelsey, New Haven County, Waterbury, October, 1917.
Margaret A. Costello, Tolland County, October, 1917.
cElizabeth K. Angell, Fairfield County, Bridgeport, October, 1917.
cMartha T. Hart, Litchfield County, Winsted, January, 1918.
Emily R. Bronson, Litchfield County, January, 1918.
Marion E. Dickenson, Fairfield County, Stamford, January, 1918.
Marie Lovsnes, Litchfield County, June, 1918.
Catherine B. Case, New London County, July, 1918.
cBessie M. Reynolds, Hartford County, Hartford, July, 1918.
cHelen I. Weed, Fairfield County, Bridgeport, July, 1918.
cMary C. Blodgett, New Haven County, Waterbury, September, 1918.
cCity Agents

Resignations

Alice Knowlton, New Haven County, September, 1917.
Nelle J. Campbell, New London County, May, 1918.
Alice B. Foote, Middlesex County, September, 1917.
Josephine Leverett, Litchfield County, December, 1917.
cAlice L. Thomas, Fairfield County, December, 1917.
cMartha T. Hart, Litchfield County, June, 1918.
cChristine Kelsey, New Haven County, July, 1918.
cElizabeth K. Angell, Fairfield County, July, 1918.
Catherine B. Case, New London County, August, 1918.
Juanita M. Dean, Hartford County, September, 1918.
cCity Agents

COUNTY CLUB LEADERS

Appointments

L. M. Johnson, Fairfield County, April, 1917.
Paul P. Ives, New Haven County, September, 1917.
Bertha A. Hallock, New London County, October, 1917.
G. A. Newton, Middlesex County, May, 1918.

Transfers

H. A. Brundage, from Assistant County Agent to County Club Leader in Hartford and Litchfield Counties, January, 1918.

P. L. Sanford, from Assistant County Agent to County Club Leader in Windham County, July, 1918.

A. C. Sheldon, from Assistant County Agent to County Club Leader in Tolland County, July, 1918.

A. W. Greer, from Assistant County Agent to County Club Leader in Middlesex County, June, 1918.

INSURANCE ON BUILDINGS AND CONTENTS AT STORRS.

Identification	Value of Buildings	Insurance on Buildings	Value of Contents	Insurance on Contents	Total Ins. on Bldgs. and Contents
1. Armory	$90,400	$25,000	$ 6,180	$ 5,000	$30,000
2. Central Heating Plant	15,000	5,000	.....	.....	5,000
3. Dairy Building	34,975	31,500	17,600	14,000	45,500
4. Dining Hall	26,000	23,400	8,500	5,500	28,900
5. Greenhouses and Florist Cottage	32,000	28,800	2,400	2,000	30,800
6. Grove Cottage	22,000	19,800	2,810	2,200	22,000
7. Horticultural Building	34,400	31,000	7,820	6,500	37,500
8. Koons Hall	105,900	25,000	3,760	3,000	28,000
9. Machinery Building	18,976	5,000	2,600	2,000	7,000
10. Main Building including Laboratory	35,366	31,800	52,640	42,500	74,300
11. Poultry Bldg.	34,400	31,000	4,030	3,000	34,000
12. Storrs Hall	92,800	83,500	7,320	5,500	89,000
13. Whitney Hall	17,300	15,600	3,730	3,000	18,600
14. Blake House	3,400	3,100	.....	.....	3,100
15. Bull Barn No. 1	680	600	600	800	1,400
16. Bull Barn No. 2 (concrete)	3,000	1,500	1,200	800	2,300
17. Carpenter Shop	1,000	600	.....	.....	600
18. Cottage No. 1	8,185	7,400	.....	.....	7,400
19. Cottage No. 3	12,100	10,900	.....	.....	10,900
20. Cottage No. 4	8,100	7,300	.....	.....	7,300
21. Cottage No. 5	12,100	10,900	.....	.....	10,900

22.	Cottage No. 6..	7,900	7,100	.....	.....	7,100
23.	Cottage No. 7..	7,900	7,100	.....	.....	7,100
24.	Cottage No. 8..	7,600	6,800	.....	.....	6,800
25.	Cottage No. 9..	7,600	6,800	.....	.....	6,800
26.	Cottage No. 10.	7,600	6,800	.....	.....	6,800
27.	Cottage No. 11.	7,600	6,800	.....	.....	6,800
28.	Cottage No. 12.	7,600	6,800	.....	.....	6,800
29.	Cottage No. 13.	8,000	7,200	.....	.....	7,200
30.	Cottage No. 14.	7,450	6,700	.....	.....	6,700
31.	Cottage No. 15.	11,900	10,700	.....	.....	10,700
32.	Cottage No. 16.	11,900	10,700	.....	.....	10,700
33.	Cottage No. 17.	7,450	6,700	.....	.....	6,700
34.	Dairy Barn....	21,200	19,100	16,720	13,000	32,100
35.	Experiment Station Office ..	3,200	2,900	1,642	1,300	4,200
36.	Farm Horse Barn	2,415	2,200	3,200	2,500	4,700
37.	Farm House ..	2,900	2,600	.....	.....	2,600
38.	Fitts House ..	5,600	5,000	.....	.....	5,000
39.	Gulley Barn..	700	600	.....	.....	600
40.	Gulley House..	3,940	3,500	.....	.....	3,500
41.	Hauschild House No. 1..	5,800	5,200	.....	.....	5,200
42.	Hauschild House No. 2..	7,800	7,000	.....	.....	7,000
43.	Horse Barn...	21,570	19,400	9,670	7,500	26,900
44.	Horse Barn Annex	2,140	1,900	2,320	1,800	3,700
45.	Horticultural Barn	500	.....	1,440	1,000	1,000
46.	Jacobson Barn	6,650	6,000	11,530	9,000	15,000
47.	Jacobson House	3,180	2,900	.....	.....	2,900
48.	Manter House.	3,200	2,800	.....	.....	2,800
49.	Office, Superintendent Bldgs.	830	700	600	.....	700
50.	Patterson House	6,130	5,500	.....	.....	5,500
51.	Phelps House..	9,190	8,200	.....	.....	8,200
52.	Poultry Barn..	1,050	900	.....	.....	900
53.	Poultry Feed House	2,850	2,600	2,600	2,000	4,600
54.	Poultryman's House	1,244	1,100	.....	.....	1,100
55.	Rosebrooks Barn	4,000	3,600	.....	.....	3,600

56.	Rosebrooks House	2,900	2,600	.....	.....	2,600
57.	Upham House.	1,250	1,100	.....	.....	1,100
58.	Valentine Cottage	1,960	1,700	.....	.....	1,700
59.	Valentine House	9,375	8,400	.....	.....	8,400
60.	Whitney Barn	1,290	1,100	1,240	900	2,000
61.	Whitney House	5,720	5,000	.....	.....	5,000
62.	Miller House, New	2,600	2,400	.....	.....	2,400
63.	Miller House, Old	1,200	1,000	.....	.....	1,000
64.	Miller Barn...	800	500	.....	.....	500
65.	New Piggery..	3,500	1,500	800	500	2,000
66.	Poultry Houses	9,150	.....	.....	.....	.....
67.	Bacteriology Shed	400	.....	.....	.....	.....
68.	Garages	1,700	.....	.....	.....	.....
69.	Experiment Station Store House	500	.....	500	.....	.....
70.	Jacobsen Shed	300	.....	.....	.....	.....
71.	Corn Crib, Valentine	300	.....	.....	.....	.....
72.	Corn Crib, Farm	150	.....	.....	.....	.....
73.	Farm Shed	300	.....	.....	.....	.....
74.	Ice House	300	.....	.....	.....	.....
75.	Blacksmith Shop*	.....	200	.....	.....	200
			.....	.....	.....	.....
	Misc. Buildings, Small	700	.....	.....	.....	.....
	Totals	$867,566.	$618,100.	$173,452.	$135,300.	$753,400.

*Not owned by College.

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1917.

COLLEGE DIVISION

Receipts

Annual State Appropriation	$ 40,000.00	
Annual Federal Appropriation	50,000.00	
Annual Federal Endowment Income	6,750.00	
Rent	10,044.88	
Interest	742.43	
Fees	11,072.24	
Hicks Prize	60.00	
Egg Laying Contest	1,873.45	
E. O. Smith Loan Fund	20.00	
Conn. Agr. Society Scholarship	50.00	
Misc. Receipts	97.32	
		$120,710.32

Drawn from Special Appropriations

Central Heating Plant (App. 1915)	71,787.24	
Buildings and Improvements (App. 1917)	4,000.00	
		75,787.24

Cash Balances, September 30, 1916

Hartford Trust Company	2,073.00	
State Fund	$1,906.30	
Hicks Prize	141.70	
Conn. Poul. Assn.	25.00	
	$2.073.00	
Windham Natl. Bank, Land Grant	127.85	
1st Natl. Bank Stafford, Morrill	38,697.85	
Accounts Receivable	1,199.37	
		42,098.07
		$238,595.63

ACCOUNTS SHOWING EXCESS OF EXPENDITURES ABOVE RECEIPTS

College Division

Salaries—		
Officers	$ 7,849.95	

Instructors—		
Agronomy	3,048.00	
Bacteriology	3,612.48	
Botany	3,691.67	
Chemistry	3,587.45	
Dairy	2,575.80	
Creamery	1,600.00	
Domestic Science	3,020.00	
Animal Husbandry	1,600.00	
Horticulture	6,991.66	
Mechanic Arts	2,000.00	
Poultry	2,941.63	
Zoology	2,989.58	
English, History & French	2,200.00	
Economics	2,249.99	
Mathematics and Physics	2,200.00	
Public Speaking, English	995.82	
Forestry	800.00	
German	495.00	
Agricultural Education	2,116.65	
Veterinary Science	519.11	
Carpentry	600.00	
Music	1,000.00	
Physical Education	166.66	
		$ 58,851.45
Employees—Administration Offices		3,718.60
Departments—		
Agronomy	965.82	
Bacteriology	1,181.67	
Botany	1,099.34	
Boarding	3,781.03	
Chemistry	1,302.21	
Creamery	6,306.03	
Dairy	4,271.47	
Domestic Science	341.07	
Animal Husbandry	5,088.20	
Horticulture	4,985.80	
Grounds	4,383.12	
Library	1,766.25	
Mathematics & Physics	339.62	
Mechanic Arts	482.89	
Military	1,363.91	
Poultry	3,598.82	
Zoology	759.70	
English, History, etc.	258.40	
Forestry	18.20	
Economics	72.28	
Physical Education	796.22	
Publicity	1,079.73	
		44,241.78

Improvements—		
Target Range		$ 500.96
Repairs and Maintenance—		
Operation & Repairs to Sewage System	$ 370.66	
Repairs to Buildings	11,977.84	
Fuel and Lights	10,083.56	
Engineer and Fireman	1,273.70	
Janitor Work and Supplies	2,583.22	
Insurance	3,152.05	
Moving Picture Machine	12.15	
		29,453.18
Supplies and Service for Students—		
Pew Rent	800.00	
Commencement	127.90	
Lectures	495.99	
Hicks Prize	35.00	
College Book Store	487.85	
Doctors and Medicines	847.92	
		2,794.66
Administration Expenses—		
Telephones and Telegrams	94.87	
Traveling Expenses	1,106.88	
Printing and Advertising	470.91	
Postage, Office Sup. & Equip.	1,545.40	
Entertainment of Guests	125.40	
		3,343.46
General Expenses—		
Cartage	12.30	
Grove Cottage (Labor & Supplies)	612.76	
Summer School	28.50	
		653.56
Gilbert Farm Loan		1,000.00
Dunham Farm		86.48
Printing Press Motor		89.53
Buildings and Improvements—		
Central Heating Plant (App. 1915)	58,963.88	
Highway Survey (App. 1915)	27.20	
Railroad Survey (App. 1915)	138.26	
Fire Apparatus (App. 1915)	326.22	
Poultry Feed House (App. 1917)	1,531.09	
Artesian Well (App. 1917)	1,295.88	
New Dining Hall (App. 1917)	111.71	
Cottages (App. 1917)	107.35	
Infirmary	10.65	
Garages	650.00	
		63,161.74

Cash Balances—			
Morrill Fund Cr.	$38,126.21		
Hicks Prize	166.70		
E. O. Smith Lc. Fund	20.00		
Scholarships	75.00		
		38,387.91	
State Fund Dr.	13,989.04		
Land Grant Dr.	147.99		
		14,137.03	
Net Funds Cr.		24,250.88	
Accounts Receivable		5,449.35	
Due from Gilbert Farm on account of loan		1,000.00	
			30,700.23
			$238,595.63

SPECIAL APPROPRIATIONS

For water and sewage system, buildings and equipment, including new cottages, central heating plant and other improvements, Legislature of 1915				$107,500.00
	Expended			Drawn
Cottages—				
Treasurer's Report 1915	$ 5,248.93			
Treasurer's Report 1916	17,687.88			
		$ 22,936.81		21,000.00
Armory—				
Furniture and grading	6,000.00			
Excavating for swim. pool	1,042.71			
Extra for skylights	780.00			
		7,822.71		7,822.71
Central Heating Plant—				
Treasurer's Report 1915		$ 94.01		
Treasurer's Report 1916		3,895.38		
Treasurer's Report 1917		58,963.88		
			$ 62,953.27	$ 75,677.29
House for Chemical Engine			30.30	
Railroad Survey			108.21	

Sewage and water			
Treasurer's Report 1915	1,878.17		
Treasurer's Report 1916	1,383.01		
		3,261.18	3,000.00
Expenditures		97,112.48	
Balance due on Contracts		14,454.70	
Total Expenditures		$111,567.18	
Total amount drawn			$107,500.00

For Infirmary, Dining Hall, Faculty Cottages and Improvements, Legislature of 1917 ..... $100,000.00

	Expended	Drawn	
Poultry Feed House	$ 1,531.09	$ 1,824.91	
Artesian Well	1,295.38	1,295.38	
Dining Hall	111.71	111.71	
Cottages	107.35	107.35	
Infirmary	10.65	10.65	
Garages	650.00	650.00	
Total Expenditures	3,706.18		
Total amount drawn		4,000.00	
Balance remaining.....		96,000.00	
			100,000.00

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1918.

COLLEGE DIVISION

Receipts.

Annual State Appropriation	$ 52,500.00
Annual Federal Appropriation	50,000.00
Annual Endowment Income	6,750.00
Hicks Endowment Income	60.00
E. O. Smith Loan Fund	10.00
State Scholarship Fund	4,000.00
Smith-Hughes Fund	2,560.38
Rent	9,298.64
Fees	17,747.13
Interest	676.19
Sale of Shorthorn Cattle to Gilbert Farm	2,256.00
Dunham Farm	1,685.96
College Print Shop	52.07
Gilbert Farm Advance in 1917	1,000.00

Reimbursement of State Fund for Expenditures in excess of 1915 Appropriation Buildings & Improvements	3,308.53	
		$151,904.90
Drawn on Appropriation for Buildings & Improvements 1917		71,537.61

FUND BALANCES OCTOBER 1, 1917.

Morrill Fund Cr.	$ 38,126.21	
Gilbert Fund	15,015.00	
Experiment Station Funds	2,249.17	
Hicks Prize Fund	166.70	
E. O. Smith Loan Fund	20.00	
Scholarship Fund	75.00	
		55,652.08
State Fund Dr.	13,989.04	
Extension Funds	1,580.09	
Land Grant	147.99	
		15,717.12
		39,934.96

FUNDS ACCOUNTED FOR AS FOLLOWS:

Cash on hand	$ 1,863.30		
Less Student Bank	1,133.43		
	$ 729.87		
Hartford Trust Co.	139.15		
Willimantic Trust Co.	20.00		
First National Bank, Stafford	24,007.95		
Middletown National Bank	15,000.00		
Phoenix National Bank	15.00		
Windham National Bank	22.99		
		$ 39,934.96	
Accounts Receivable (College Division)			$ 5,449.35
State Appropriation Experiment Station		7,500	
Federal Appropriation Experiment Station		13,750.00	
Accounts Receivable Experiment Station		969.86	
			22,219.86
State Appropriation Extension Service		35,000.00	
Federal Appropriation Extension Service		14,308.01	
			49,308.01
Gilbert Fund Income (Dividends)		20,400.00	
Gilbert Fund Income (Interest)		576.46	
			20,976.46
			$361,331.15

ACCOUNTS SHOWING EXCESS OF EXPENDITURES OVER RECEIPTS.

COLLEGE DIVISION

Administration—				
Officers' Salaries ...	$ 9,285.39			
Office Employees ..	6,908.97			
Post., Print. & Sup.	3,538.61			
Travel	1,860.36	21,593.33		
Receipts		305.21	21,288.12	
Expenses of Trustees			527.51	
Publicity Committee				
Salaries	150.00			
Labor	93.77			
Supplies	1,397.19			
Travel	1.00	1,641.96		
Receipts		22.48	1,619.48	
Miscellaneous Expenses	498.67			
Cartage	4.50	503.12		
Receipts		88.89	414.23	
Entertainment of Guests			28.92	
Telephone & Telegraph		595.50		
Receipts		77.26	518.24	$ 24,396.50
Departments of Instruction—				
Agronomy				
Salaries	4,360.38			
Labor	266.36			
Supplies	446.32			
Travel	53.22	5,126.27		
Receipts		60.03	5,066.24	
Agricultural Education				
Salaries				
Supplies			2,565.88	
Bacteriology				
Salaries	4,116.66			
Labor	585.94			
Supplies	382.87			
Travel	2.00	5,086.47		
Receipts		249.76	4,836.71	
Botanical				
Salaries	3,943.65			
Labor	868.91			
Supplies	560.14			
Travel	28.55	5,401.25		
Receipts		256.95	5,144.30	

Chemical			
Salaries	4,004.15		
Labor	87.40		
Supplies	3,928.03		
Travel	65.71	8,085.29	
Receipts		3,129.24	4,956.05
Creamery			
Salaries	1,200.01		
Labor	2,977.45		
Supplies	12,471.49		
Travel	4.49	16,653.44	
Receipts		10,925.24	5,728.20
Dairy			
Salaries	1,912.44		
Labor	3,417.54		
Supplies	16,569.66		
Travel	109.24	22,008.88	
Receipts		13,134.41	8,874.47
English & History			
Salaries)			
Supplies)	3,389.14		3,389.14
Economics			
Salaries)			
Supplies)			1,903.47
Farm			
Salaries	3,420.76		
Labor	14,122.11		
Supplies	16,342.19		
Travel	124.24	34,009.30	
Receipts		25,455.34	8,553.96
Forestry			
Salaries	1,000.00		
Labor	1,280.18		
Supplies	482.59	2,762.77	
Receipts		1,758.59	1,004.18
Gardening			
Salaries	1,951.00		
Labor	1,249.73		
Supplies	837.07	4,037.80	
Receipts		1,023.42	3,014.38
German			528.43
Grounds			
Salaries	975.00		
Labor	2,578.60		
Supplies	1,039.44		
Travel	2.40	4,595.44	
Receipts		2,799.01	1,796.43

Greenhouse			
Salaries	650.00		
Labor	2,009.25		
Supplies	883.58	3,542.83	
Receipts		528.62	3,014.21
Grove Cottage			
Labor	130.22		
Supplies	147.52	277.74	
Receipts		44.29	233.45
Home Economics			
Salaries	2,456.06		
Labor	9.23		
Supplies	350.77		
Travel	32.95	2,849.01	2,849.01
Library			
Salaries	108.33		
Labor	928.06		
Supplies	1,015.79	2,052.18	
Receipts		120.43	1,931.75
Mathematics & Physics			
Salaries	2,383.33		
Labor	105.66		
Supplies	145.70	2,634.69	
Receipts		8.58	2,626.11
Mechanic Arts			
Salaries	2,166.66		
Labor	41.20		
Supplies	508.78	2,716.64	
Receipts		4.52	2,712.12
Military			
Labor	376.00		
Supplies	3,157.38	3,533.38	
Receipts		3,012.06	521.32
Pomology			
Salaries	1,866.66		
Labor	1,685.30		
Supplies	1,532.30	5,084.26	
Receipts		2,441.92	2,642.34
Poultry			
Salaries	3,299.98		
Labor	1,258.49		
Supplies	2,043.94		
Travel	138.37	6,740.78	
Receipts		1,650.75	5,090.03
Public Speaking			
Salaries)			
Supplies)		1,070.10	1,070.10

Summer School				
Labor		15.00	15.00	
Veterinary Science				
Salaries		230.00	230.00	
Zoology				
Salaries	3,250.00			
Labor	147.10			
Supplies	568.59			
Travel	14.11	3,979.80		
Receipts		25.10	3,954.70	84,251.98
Repairs and Maintenance—				
Fuel & Light	25,167.25			
Janitor Work & Sup.	2,633.56			
Insurance	4,573.53			
Repairs to Bldgs. ..	12,898.43			45,272.77
Supplies and Service to Students—				
Pew Rent for Students	800.00			
Lectures and Entertainments	192.79			
Nurse & Medical Service	670.33			
Commencement	195.93			1,859.05
Other Expenditures not included in Budget—				
Boarding Department				
Salaries	1,400.00			
Labor	6,431.80			
Supplies	24,550.13			
Travel	221.72	32,603.65		
Receipts		32,164.63	439.02	
Book Store				
Supplies	10,891.59			
Sales	10,583.06		308.53	
Competition				
Labor	3,770.85			
Supplies	10,239.18			
Travel	22.95	14,032.98		
Receipts		12,759.11	1,273.87	
New Chemical Lab. (Fire Loss)			1,606.22	
Laundry			60.09	
Military Misc.			106.75	
Central Heating Plant			10,020.42	
Purchase of Miller Farm			5,000.00	18,814.90
TOTAL				$174,595.20

Recapitulation				
Salaries	67,158.40			
Labor	53,678.13			
Supplies	189,758.25			
Travel	2,714.19	313,308.97		
Total Receipts		153,734.19	159,574.78	
Central Heating Plant			10,020.42	
Purchase of Miller Farm			5,000.00	174,595.20
Forward				174,595.20
Building & Improvements, Appropriation 1917—				
Architect Services			1,200.00	
Artesian Well			5,269.37	
Bull Barn			2,963.08	
Cottages			6.22	
Coal Bunker			1,766.43	
Dining Hall			2,463.37	
Fitts House			4,300	
Garages			815.54	
Grading & Walks			2,500.00	
Hauschild Houses			12,000.00	
Infirmary			1.12	
Live Stock (Farm)			2,375.00	
Patterson House			5,552.80	
Poultry Buildings			7,424.55	
Piggery			3,352.86	
Reservoir			1,429.41	
Reimbursements State Fund Maintenance, Expended for Buildings & Improvements, 1915			3,308.53	
Rosebrooks Farm			8,000.00	
Sewage Pump			288.20	
Storage Shed—Bacteriology Department ..			425.33	
Upham Property			3,293.36	
Valentine Property			7,000.00	
Whitney Cottage			7,504.89	
				83,240.06
Forward				$257,835.26

Forwarded			257,835.26
Gilbert Farm		17,808.55	
Extension Division		46,647.69	
Experiment Station Division		18,108.69	
Compensation, Account Jacob Boglisch		357.50	
Accounts Receivable College		6,179.87	
Accounts Receivable Station		1,141.81	
Accounts Receivable Extension		306.93	
Scholarship Notes Receivable		500.00	
			91,051.04

FUND BALANCES

Experiment Station Credit	5,231.99		
Extension Service Credit	773.30		
Gilbert Fund	18,182.91		
Morrill	42,064.19		
Scholarship Fund	75.00		
State Scholarship Fund	3,587.74		
E. O. Smith Loan Fund	30.00		
Hicks Prize	226.70		
		70,171.83	
State Fund Debit	56,816.51		
Land Grant Debit	472.98		
Smith-Hughes Debit	437.49		
		57,726.98	
Net Funds Credit			12,444.85
			$361,331.15

ACCOUNTED FOR AS FOLLOWS

Cash in Vault	1,770.32		
Less Students' Bank	1,061.83		
		708.49	
Middletown National Bank		10,938.46	
First National Bank, Stafford Springs		7.00	
Windham National Bank		22.99	
Willimantic Trust Co.		3,867.74	
		15,544.68	
Less Hartford Trust Co. Overdraft		3,099.83	
Total			$12,444.85

DUNHAM FARM

Receipts

Sale of Produce, etc.		$ 2,905.26

Expenditures

Labor	$ 600.05	
Supplies	537.00	
Travel	82.25	
	1,219.30	
Receipts over expenditure	1,685.96	
		2,905.26

PRINT SHOP

Receipts

Sales	2,466.44	

Expenditures

Labor	1,275.53	
Supplies	1,132.88	
Travel	5.96	
	2,414.37	
Receipts over expenditures	52.07	
		2,466.44

SCHOLARSHIP FUND

State Appropriation	4,000.00	
Interest	87.74	
		4,087.74
Transferred to Fee Account for Scholarship		500.00
Fund Balance		$3,587.74

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1917.

EXPERIMENT STATION DIVISION

Receipts

Annual Federal Appropriation	$ 15,000.00
Annual State Appropriation	4,500.00
Interest	55.90

Department Sales—			
Chemical	$ 35.00		
Agronomy	700.34		
Dairy	4,268.55		
Poultry	3,428.85		
Zoology	73.76		
Miscellaneous	156.50		
		8,663.00	
Cash Balance, October, 1916	22.69		
Accounts Receivable, October 1, '16	385.49		
		408.18	
			$28,627.08

DEPARTMENT EXPENDITURES

Administration	$ 2,276.38	
Agronomy	5,609.20	
Chemistry	1,755.87	
Dairy	6,555.94	
Poultry	8,058.71	
Zoology	1,151.95	
Funds Balance	2,249.17	
Accounts Receivable	969.86	
		$28,627.08

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1918.

EXPERIMENT STATION DIVISION

Receipts

State Appropriation		$ 7,500.00	
Federal Appropriations			
(Hatch & Adams Fund)	$ 15,000.00		
Due on Hatch & Adams Funds July 1, 1918 but not received until after Sept. 30, 1918.	1,250.00	13,750.00	
Funds Balance October 1, 1917		2,249.17	
			$ 23,499.17

DEPARTMENTS SHOWING EXCESS OF RECEIPTS OVER EXPENDITURES.

Chemical	$ 1,028.87	
Dairy Testing	117.43	
Poultry Testing	148.48	$1,294.78
Total Funds Available		$ 24,793.95

DEPARTMENTS SHOWING EXCESS OF EXPENDITURES OVER RECEIPTS.

Administration			
Salaries	$ 1,126.58		
Labor	602.16		
Supplies	360.67		
Travel	301.98	$2,391.39	
Receipts		9.47	$2,381.92
Agronomy			
Salaries	2,756.54		
Labor	2,774.34		
Supplies	2,004.87		
Travel	166.44	7,702.19	
Receipts		1,857.83	5,844.36
Animal Diseases			
Salaries	1,199.96		
Labor	755.67		
Supplies	232.15		
Travel	124.84	2,312.62	
Receipts		24.00	2,288.62
Dairy			
Salaries	2,268.27		
Labor	1,013.46		
Supplies	1,319.55		
Travel	98.83	4,700.11	
Receipts		1,064.64	3,635.47
Poultry			
Salaries	3,439.03		
Labor	936.78		
Supplies	3,149.62		
Travel	127.66	7,653.09	
Receipts		3,697.40	3,955.69
Zoology			
Salaries	1,079.12		
Labor	96.85		
Supplies	102.57		
Travel	4.60	1,283.14	
Receipts		23.00	1,260.14
Miscellaneous Expense			
Supplies	25.96	25.96	
Receipts		2.15	23.81
Total Expenditures			19,890.01
Balance on Hand			5,403.94
			$24,793.95

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1917.

EXTENSION SERVICE DIVISION.

Receipts

Smith Lever Fund	$ 13,143.68		
State Fund	7,500.00		
Special State Appropriation	10,000.00		
State Editorial Ass'n. for Pig Clubs	50.00		
Hartford Rubber Works, Agronomy	50.00		
Sperry & Barnes for Pig Club Work	400.00		
L. S. Storrs for Boys & Girls Clubs	25.00		
Interest	33.53		
Miscellaneous	34.09		
Cash Balance, September 30, 1916	371.86	$31,608.16	
Deficit		1,580.09	
			$ 33,188.25

EXPENDITURES.

Administration			
Salaries and Labor	3,971.69		
Equipment & Supplies	650.31		
Traveling Expenses	549.88	5,171.88	
Publications		1,757.29	
County Agents			
Salaries and Labor	4,419.00		
Supplies	22.17		
Traveling Expenses	402.40		
		4,843.57	
Boys' & Girls' Clubs			
Salaries and Labor	1,584.07		
Supplies	524.77		
Traveling Expenses	1,542.84		
		3,651.68	
Poultry Demonstrations			
Salaries and Labor	1,605.16		
Supplies	100.06		
Traveling Expenses	951.27		
		2,656.49	
Dairy Demonstrations			
Salaries and Labor	974.46		
Supplies	134.81		
Traveling Expenses	892.90		
		2,002.17	

Farm Management			
Salaries and Labor	850.74		
Supplies	53.32		
Traveling Expenses	601.48		
		1,505.54	
Farmers Institutes			
Salaries and Labor	95.00		
Supplies	99.74		
Traveling Expenses	266.52		
		461.26	
Home Economics			
Salaries and Labor	250.75		
Supplies	32.55		
Traveling Expenses	341.25		
		624.55	
Extension Schools			
Salaries and Labor	259.31		
Supplies	212.64		
Traveling Expenses	109.04		
		580.99	
Fair Exhibits		931.95	
Pig Club		866.28	
Marketing		99.73	
Agronomy Ext.		908.01	
Contingent		5,328.81	
Agricultural Economics		1,280.48	
Agricultural Education		303.40	
Special Fund		45.00	
Fruit Growing		39.23	
Freight, Express and Drayage		129.94	
			$ 33,188.25

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1918.

EXTENSION SERVICE DIVISION

Receipts		
State Appropriation	$ 30,000.00	
From State Council of Defense	5,090.00	
Smith-Lever Federal Fund	14,308.01	
	49,408.01	
Less Deficit 1917	1,580.09	
Total Funds available		$ 47,727.92

Administration			
Salaries	$ 3,952.52		
Labor	207.81		
Office Supplies	1,028.99		
Travel	608.21	$ 5,797.53	$ 5,797.53
Ag. Economics			
Salaries	1,915.83		
Labor	6.80		
Supplies	197.27		
Travel	1,375.55	3,495.45	
Receipts		297.07	3,198.38
Ag. Education			
Travel	65.94		65.94
Agronomy			
Salaries	1,254.66		
Labor	1.65		
Supplies	251.88		
Travel	541.79	2,049.98	
Receipts		22.50	2,027.48
B. & G. Clubs			
Salaries	1,717.17		
Labor	154.21		
Supplies	1,619.80		
Travel	1,407.52	4,898.78	
Receipts		1,558.33	3,340.37
Contingent			
Salaries	37.50		
Labor	119.53		
Supplies	1,539.61		
Travel	2,396.14	4,092.78	
Receipts		2,127.36	1,965.42
County Agents			
Salaries	7,516.95		
Labor	69.40		
Supplies	416.64		
Travel	936.14	8,939.13	
Receipts		157.22	8,781.91
Dairying			
Salaries	1,068.94		
Labor	251.05		
Supplies	536.10		
Travel	668.83	2524.92	
Receipts		163.80	2361.12
Exten. Sch.			
Labor	9.40		
Supplies	128.44		
Travel	9.10	146.94	146.94

Fair Exhibits			
Labor	238.15		
Supplies	1,184.16		
Travel	619.42	2,041.73	
Receipts		796.63	1,245.10
Farmers Inst.			
Supplies	26.00		
Travel	21.81	47.81	47.81
Farm Management			
Salaries	899.33		
Labor	1.05		
Supplies	306.07		
Travel	541.35	1,747.80	
Receipts		144.73	1,603.07
Fruit Growing			
Salaries	499.93		
Supplies	21.14		
Travel	184.36	705.43	
Receipts		353.21	352.22
Home Econ.			
Salaries	2,468.98		
Labor	8.45		
Supplies	360.97		
Travel	2,096.50	4,934.90	
Receipts		1,089.23	3,845.67
Poultry			
Salaries	2,155.83		
Labor	4.00		
Supplies	271.59		
Travel	1,127.09	3,558.51	
Receipts		1.43	3,557.08
Publicity Committee			
Salaries	1,440.00		
Labor	69.80		
Supplies	1,358.65		
Travel	1,009.81	3,878.26	
Receipts		39.74	3,838.52
Sheep Hus.			
Supplies	63.58		
Travel	405.30	468.88	
Receipts		.31	468.57
Pig Clubs			
Salaries	629.49		
Labor	13.85		
Supplies	376.18		
Travel	976.93	1,996.45	
Receipts		458.22	1,538.23

Total Department (Smith Lever and)		
Expenditures (State Appropriation)		44,181.36
Salary Advance (To be returned from U. S. D. A.)		2,466.33
Balance		
Accounts Receivable	306.93	
Funds	773.30	1,080.23
		$47,727.92

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1917.

GILBERT FARM

Receipts.

Bank Balance, October 1, 1916	$ 16,576.20	
Income on Endowment	24,000.00	
Interest	286.72	
Balance of advance to Geo. Eaton, Jr.	1,419.43	
Transfer of stock to College	2,266.34	
Advance from College Funds	1,000.00	
		$ 45,548.69

Farm Receipts.

Dairy	453.24	
Poultry	5,006.70	
Swine	3,776.37	
Stock	834.65	
Miscellaneous	104.33	
		10,175.29
		55,723.98

Expenditures.

Labor	9,117.44	
Supplies and Miscellaneous	14,172.91	
Equipment	2,883.99	
Stock	6,030.17	
Transportation	606.74	
Traveling Expenses	182.75	
Feed	6,672.94	
Blacksmithing	164.67	
Fuel & Lights	411.02	
Advertising	12.00	
Insurance	399.15	
Telephones & Telegrams	55.10	
Bank Balance, September 30, 1917	15,015.00	
		$55,723.98

FINANCIAL REPORT FOR YEAR ENDING SEPT. 30, 1918.

GILBERT FARM

Receipts.

Cash Balance, Oct. 1, 1917	$ 15,015.00	
Endowment Income	20,400.00	
Interest	576.46	
Poultry	395.72	
Swine	8,845.72	
		$ 45,232.90

Expenditures in Excess of Receipts.

Boarding			
Labor		530.87	
Supplies		1,990.19	
			2,521.06
Boys' Expenses			
Labor	46.50		
Supplies	955.06		
		1,001.56	
Receipts		8.00	
			993.56
Farm			
Labor	6,846.54		
Supplies	12,746.42		
Travel	65.04		
		19,658.00	
Receipts		1,105.76	
			18,552.24
Special Stock Account			
Cost of Stock		12,571.18	
Receipts		10,254.99	
			2,316.19
Misc. Expense			1,430.67
Traveling Expense			236.27
Reimbursement of College Fund for Loan in 1917			1,000.00
Total Expenditures			27,049.99
Fund Balance			18,182.91
			$45,232.90

41

rd, Conn., Jan. 10, 1918.

ed the accounts of R. I. Long-
ltural College, for the fiscal
ve found them correct. The
vs:

er 1, 1917.

.....$	38,126.21	
.....	15,015.00	
.....	2,249.17	
.....	166.70	
.....	20.00	
.....	75.00	
		$ 55,652.08
.....	13,989.04	
.....	1,580.09	
.....	147.99	
		15,717.12
.....		$39,934.96

As Follows:

,863.30		
,133.43		
	729.87	
.....	139.15	
.....	20.00	
.....	24,007.95	
.....	15,000.00	
.....	15.00	
.....	22.99	
		$39,934.96

WILLIAM P. BAILEY,
JAMES P. TOBIN,
Auditors of Public Accounts.

Hartford, Conn., Jan. 10, 1919.

This is to certify that we have audited the accounts of R. I. Longley, Treasurer of the Connecticut Agricultural College, for the fiscal year ending September 30, 1918, and have found them correct. Th balances September 30, 1918, are as follows:

Experiment Station Credit	$ 5,231.99	
Extension Service Credit	773.30	
Gilbert Fund	18,182.91	
Morrill	42,064.19	
Scholarship Fund	75.00	
State Scholarship Fund	3,587.74	
E. O. Smith Loan Fund	30.00	
Hicks Prize	226.70	
		$ 70,171.83
State Fund Debit	56,816.51	
Land Grant Debit	472.98	
Smith-Hughes Debit	437.49	
		57,726.98
Net Funds Credit		$12,444.85

Funds Accounted For As Follows:

Cash in vault	$ 1,770.32		
Less Student Bank	1,061.83		
		$ 708.49	
Middletown National Bank		10,938.46	
First Nat. Bank Stafford		7.00	
Windham Nat. Bank		22.99	
Willimantic Trust Co.		3,867.74	
			$ 15,544.68
Less Hartford Trust Co. overdraft			3,099.83
			$ 12,444.85

WILLIAM P. BAILEY,
JAMES P. TOBIN,
Auditors of Public Accounts.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 197 NOVEMBER, 1917

ECONOMY IN FEEDING THE FAMILY

II

The Cereal Breakfast Foods

By JOHN PHILLIPS STREET

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Cereal Breakfast Foods.

The cereal foods occupy a very important place in the diet of the American family, both in sickness and in health. Vegetable foods supply about 95 per cent. of the carbohydrates in the average dietary, and the cereal foods themselves supply fully 55 per cent. Grains in the raw state are unattractive to the taste and are somewhat difficult of digestion, and for this reason cereals are generally cooked before eating. The oldest method of cooking them was by parching, and in the early days the Scotchman's oatmeal and the Indian's maize were prepared in this way. The next development was porridge, in which the grain was boiled or steamed with water, milk or meat stock, and thus rendered more palatable. Porridge, however, requires long cooking, its keeping qualities are poor, and it is far from being a convenient food preparation. In spite of these disadvantages—and the necessary long cooking is by no means an unqualified disadvantage—porridge has enjoyed a wide use and popularity, and the modern cereal breakfast food is its lineal descendant.

A generation ago practically the only cereal foods on the market were wheat flour, corn meal, hominy and hulled corn; barley, rye and rice finding only a very limited use. At the present time we find an almost endless number and variety of specially prepared breakfast foods offered for our use. Many of the brands, however, are exploited by extensive and expensive advertising and live only so long as a fluctuating public taste demands them. Some endure but for a season, while others have taken a fixed place in the long list of American food materials.

Types of Cereal Breakfast Foods.

However, while the brand names of the foods may change, the types of cereal breakfast foods which they represent persist from year to year. There are four main types of these foods: those in which the grain is simply husked and more or less crushed or ground; those which have been steamed or partially cooked at the factory and then ground or rolled and dried; those which have

been cooked by dry heat only, such as puffed rice or wheat; and those in which more or less of the insoluble starch has been converted into soluble form by the action of barley malt, as in the so-called malted foods.

The grains used in this country in these products are oats, wheat, corn, rice, and less commonly barley and rye. Although the various flours, starches, and edible cereal pastes (noodles, macaroni, vermicelli and spaghetti) are in a sense cereal breakfast foods, they will not be discussed at this time.

Oats is characterized by its high protein and fat content; wheat, rye and barley by high protein and moderate fat; corn by its relatively high fat; while rice is distinctly low in protein, and in the polished form almost free from fat, fiber and ash. These characteristics of the individual grains greatly affect the composition of the breakfast foods made from them, as will be shown later. In the preparation of certain breakfast foods the grain is used in its entirety; in others more or less of the germ is removed, thus materially reducing the percentage of fat; in others the ground product is thoroughly bolted to remove most of the fiber; while in still others the use of heat or a malting process materially alters the form of carbohydrates present. To certain of the "ready-to-eat" brands, salt, sugar, syrup, or honey has been added, thus increasing the ash or carbohydrates and decreasing the relative percentages of the other ingredients. In general, however, the composition of the finished breakfast food closely follows that of the parent grain.

Barley is not a popular breakfast cereal in this country, and when used it is usually in the form of "pearled" barley with a much lower content of fiber and considerably less of all the other ingredients, except carbohydrates, than the unhulled, untreated grain.

The germ of the corn kernel is rich in fat, which tends to become rancid on keeping, and more or less of it is generally removed in the preparation of corn breakfast foods. Hominy, samp and cerealine are names used quite loosely for corn products, which differ little from one another in composition, save that hominy generally carries a little more fat. They are all essentially carbohydrate foods. The toasted and flaked corn preparations are steamed and rolled grains, which have been

cooked longer, and to which salt and a sweetening material are commonly added.

In the oatmeal of our forefathers much of the hull or husk remained in the ground product, but with modern improved processes more of the fibrous hull is removed. The germ is not removed from the oat preparations. In the crushed or flaked oat foods the grain is more or less cooked with steam, and while still moist rolled into thin flakes and dried. Such products are, of course, only partially cooked, and further cooking is necessary before using.

The rice foods come to us either flaked, or as "puffed" rice. In the latter form the rice has been treated by a special process of cooking with dry heat, the resultant product resembling somewhat popcorn in flavor and texture.

In the preparation of wheat breakfast foods the germ, as a rule, is not removed, and save in farina and the gluten preparations more or less of the bran and middlings are retained. In certain products the whole grain, bran and all, is used. The unground wheat grain is seldom used as breakfast food, except in the "puffed" products (prepared similarly to puffed rice), and in frumenty, in which the husked grain is boiled with milk and spices. The latter preparation has but a restricted use in this country. Where the grain is only moderately crushed and the bran not removed, the product is known as cracked wheat or wheat grits. The flaked wheat foods are prepared in the same way as rolled or flaked oats. Shredded wheat is prepared by a special process and represents the whole grain. The gluten breakfast foods are characterized by a very high protein content and contain only about half the starch usually found in wheat foods. They are intended primarily for those to whom much starch in the diet is objectionable, but as a rule the extent to which the starch has been removed falls far short of the manufacturer's claims.

In the so-called malted foods advantage is taken of the diastatic power of barley malt, the diastase of malt imitating the action of the ferments of the saliva and pancreatic juice. Generally the amount of malt added is not sufficient to convert more than a part of the starch into soluble forms. Analysis shows that in many of these foods the soluble carbohydrates

exist largely in the form of dextrin and suggests the possibility of glucose or some other soluble dextrin-containing carbohydrate being added. Furthermore, it must not be forgotten that the treatment of starch with dry heat also produces dextrin, as illustrated in the case of ordinary toast. It is evident, therefore, that many of these "malted" foods are not deserving of the name.

Still another group of breakfast foods now quite widely used includes the various laxative preparations. These usually consist chiefly either of wheat bran or some inert material, such as agar-agar or Iceland moss. In some instances fruits and nuts are used and occasionally an oil, such as olive oil, or linseed oil.

Composition of Cereal Foods.

Aside from the constituent grains and the method of manufacture, the cereal breakfast foods are of two general classes, those which are either raw and which need prolonged cooking or which have been cooked to some extent and need further treatment before use, and those which are "ready-to-eat." Pearled barley, hominy, samp, corn meal, oat flakes, cracked wheat and farina are types of the first class, while among the "ready-to-eat" preparations we find such products as cerealine, corn flakes, rice flakes, wheat flakes, puffed rice, shredded wheat, Grape-nuts and some of the various "malted" foods. Table I, pages 32 to 39, gives the analyses of 130 of these products examined in this laboratory between 1909 and the present time, 32 being analyses just made. In addition to the chemical composition the claimed weight of the package (which was generally found to be correct) is given together with the calories yielded by one-fourth pound of the food, and the cost per package, per pound and per 100 calories. The costs are based on New Haven prices maintaining on September 26th of this year. These costs will be discussed in more detail later.

Comparative Food Value of the Cereal Breakfast Foods.

In order that the relative composition of these foods may be shown more clearly, an abridged table, Table II has been prepared, in which the average data for the different types are given, grouped under the two headings, "to be cooked" and "ready-to-serve." See pages 24 and 25.

Among the foods requiring further cooking the superiority, from a nutritive standpoint, of the oat meals is apparent at a glance. They contain from 50 to 100 per cent. more protein and from three to nine times as much fat as the other "to-be-cooked" products. In fact, they are the only breakfast foods, aside from certain laxative preparations, that contain any considerable percentage of fat, and indeed for this reason they have been criticized as "heating" foods and undesirable for use in hot weather and by people suffering from certain types of disease. An average serving of rolled oats, however, contains only about 1 1-3 ozs. of the dry cereal, and a daily consumption of this amount for four months would supply only about as much fat as 2-3 lb. of butter. The "heating" effect of oat preparations, therefore, obviously may be neglected except under most unusual conditions. If oatmeal supplies so little fat in the ordinary dietary, it is apparent that the amounts supplied by the other "to-be-cooked" cereals is almost negligible. This further emphasizes the fact that, while these foods contain important percentages of protein, they are, with the exception of the oatmeals, essentially carbohydrate foods.

While among the "ready-to-eat" preparations considerable variations are shown in all the ingredients except the carbohydrates, the most striking differences, as we have shown elsewhere, are in the amounts of carbohydrate rendered soluble in water by the various manufacturing processes. Only about 10 per cent. of the carbohydrates of flaked rice, *Shredded Wheat* and *Triscuit* are water-soluble, raising a serious question as to the desirability of the extensive use of such foods in the dietaries of young children. Flaked wheat shows only about 15 per cent., while on the other hand, flaked corn shows 26, puffed rice 32, puffed wheat 27 and *Grape-Nuts* 36 per cent. of water-soluble carbohydrates.

From a nutritive standpoint, the table shows that these types of breakfast foods, excepting possibly the oatmeals and *Holland Rusk,* are practically interchangeable. While one-quarter of a pound of oatmeal or Holland Rusk yields 430 calories, the same quantity of each of the other foods listed yields approximately the same number of calories, 400. For all practical purposes, therefore, it may be assumed that one ounce of any of the commonly used breakfast foods yields about 100 calories. An attempt has been made in the table to indicate in terms of familiar

TABLE II.—AVERAGE COMPOSITION AND COSTS OF

Type.	Pounds per hundred.		
	Protein.	Fat.	Carbohydrates.
To Be Cooked.			
Corn meal	7.5	0.8	78.7
Hominy and samp	7.9	0.7	76.9
Oat meal (Bestovotes)	16.2	6.6	63.1
Oats, rolled	15.6	6.6	64.4
Groats, Robinson's	12.8	8.6	67.7
Farina	10.9	1.3	74.4
Wheat, flaked	11.1	2.1	73.4
Wheat, cracked	9.3	2.3	73.3
Post Tavern Porridge	10.3	0.8	74.5
Ready To Serve.			
Corn flakes	6.9	0.3	78.6
Corn, puffed	8.7	0.3	78.5
Rice flakes	10.0	0.4	81.3
Rice, puffed	7.6	0.2	79.5
Wheat flakes	9.3	1.1	80.5
Wheat, puffed	13.1	1.8	70.2
Wheat, shredded	11.0	1.4	75.0
Triscuit	11.0	1.4	73.9
Force	10.6	1.1	73.7
Grape-Nuts	11.5	0.6	74.2
Holland Rusk	12.1	5.1	70.4
Kellogg's Krumbles	12.0	1.2	72.3

measure the volume of the different foods weighing one ounce and yielding 100 calories. For instance, 1 *Shredded Wheat* biscuit, 2½ *Triscuits*, 2/5 cup rolled oats, 1¼ cups corn flakes, or 4 heaping tablespoonfuls of *Grape-Nuts* each yields 100 calories and weighs about one ounce.

DIGESTIBILITY OF THE CEREAL BREAKFAST FOODS.

The value of a food depends not only upon the amounts of nutrients present but also upon their digestibility. Experiments with healthy men have shown that partially cooked wheat preparations have the highest digestibility and those made from unbolted wheat the lowest. Experiments at the Maine Experiment Station with rolled oats, rolled wheat, corn meal, hominy and certain

TYPICAL BREAKFAST FOODS IN PACKAGE FORM.

Cost.			Calories per ¼ lb.		Necessary to yield 100 Calories.	
Per pound.	Per 100 calories.	Per serving.	Total.	From protein.	Volume.	Weight.
cts.	cts.	cts.				oz.
8	0.50	0.81	402	34	1/5 cup*	1
10.5	0.66	1.01	401	39	1/6 "	1
10	0.58	0.74	430	73	1/5 "	0.9
9	0.56	0.75	432	71	2/5 "	1.1
50	2.74	3.50	456	59	1/5 "	0.9
13.5	0.86	1.31	403	49	1/4 "	1
10	0.61	0.64	408	50	1/2 "	1
15.5	0.97	1.80	401	42	3/10 "	1
10	0.63	0.89	396	47	1/5 "	1
18	1.18	0.97	394	31	1 1/4 "	1
37.5	2.33	1.83	402	39	1 1/3 "	1
30	1.78	1.37	422	45	1 1/3 "	1
56	3.50	2.45	400	34	1 1/4 "	1
30	1.78	1.46	422	42	1 "	1
60	3.76	1.99	399	60	2 "	1
16	0.98	1.00	408	50	1 bisc.	1
20	1.24	1.50	403	50	2 1/2 bisc.	1
17.5	1.10	1.40	397	48	1 cup	1
16	1.01	1.16	398	52	4 tablesp.	1
29	1.69	.....	430	55	.....	.....
16	1.01	2.05	398	54	1 cup	1

* A cup equals ½ pint.

specially prepared brands, showed that in general about 90 per cent. of the organic matter was digested. The general conclusion from these experiments was that rolled wheat showed the highest and the corn products the lowest digestibility, oats occupying an intermediate position. When the actual nutrients are compared with the total nutrients it is seen that the relation previously noted still maintains; that is, the oat preparations provide the largest amounts of digestible protein and fat, followed by wheat, rye and barley, while the corn and rice products supply but relatively small amounts of these elements and relatively large amounts of carbohydrates. Other Maine experiments bring out the interesting fact that the processes to which certain products

have been subjected during their manufacture, while converting a part of the starch into soluble carbohydrates, have at the same time diminished the digestibility of the protein. For instance, rolled wheat showed 85 per cent. protein digestibility, while *Force* and *Grape-Nuts* showed but 76 and *Shredded Wheat* only 58. These and other experiments show that the raw cereals, if sufficiently cooked, are as quickly and as easily digested as the best malted cereals, and more quickly than the ordinary prepared cereals and a large majority of the so-called malted cereals.

The Cooking of Breakfast Foods.

The proper cooking of any food is a very important factor in its digestibility. Aside from the usefulness of heat in sterilizing food, the main purposes of cooking are to improve the food's appearance and flavor, to break down certain refractory elements and to convert the nutrients into more assimilable forms.

The manufacturing processes used in these foods—crushing, rolling, steaming, parching, puffing or shredding—all to a greater or lesser degree rupture the cells of the grain, and thus render the cell contents more susceptible to the action of the digestive juices of the body. As a rule, however, even some of the "ready-to-eat" foods come to us in a form which requires more cooking before their nutrients can become entirely available to the body. In the average home the over-cooking of cereals is most unsual; on the other hand, undercooking is all too common. This tendency is fostered by the claims of the breakfast food label, and we have offered to us "15-minute" oat flakes and similar alluring and alleged time-conserving preparations. The consumer has no way of knowing how much of the needed cooking has been performed by the manufacturer, and he may safely assume that the directions accompanying the food underestimate rather than exaggerate the time necessary for proper preparation. Frequently the prepared foods are condemned as indigestible simply because the cooking period has been too limited; but theoretically there is no reason why, if properly cooked, they should not be quite as digestible as cereals cooked entirely in the home. No hard and fast rule can be laid down as to the proper cooking period for the various cereals, but generally speaking the

greater the amount of husk or hull present the longer the food should be cooked.

Cost of Cereal Breakfast Foods.

In Table I the cost of the foods is shown on the basis of the package, the pound and the 100 calories. The cost is omitted in a number of instances, either because the food could no longer be found in this State or because, with the present greatly increased prices of all commodities, it was unsafe to assume any price for these without a direct inspection of the package as to its net contents. Omitting such unusual preparations as *Colax* and *Sea Moss Farina,* both in a sense medicine rather than food, the cost per pound ranges from 6.5 cents in a wheat bran to 76 cents in *Dieto Rusks.* Of the preparations requiring cooking, the corn products are the cheapest, followed by oats, with the wheat foods the most expensive. (*Robinson's Groats* is an imported food primarily intended for invalid use, and its high cost removes it from the category of family breakfast foods.) The specially prepared foods cost from two to seven times as much per pound as the simple cereal preparations, such as oatmeal, farina and hominy.

In a consideration of cost, however, composition must not be overlooked, and judged on this basis oatmeal is by far the cheapest of all the cereal breakfast foods. Nor must we forget that while we pay very much more for the prepared than for the uncooked foods, this price is in part justified by their convenience, and the saving in both time and fuel by the shortening of the home-cooking period. In hotels, hospitals and large establishments where a fire is kept throughout the day for other purposes, the prolonged cooking required by the raw cereals may be effected with practically no expense. In households where a gas stove is used exclusively for cooking, and then only at specified and limited times, it is indeed a question whether the "ready-to-eat" brands may not in many cases be the more economical purchase.

The Increased Cost of Cereal Foods.

In the case of 22 brands we have full data as to the size of the package and its cost for both the years 1909 and 1917. By referring to Table III it will be seen that in nearly every case the net

TABLE III.

COMPARATIVE PACKAGE WEIGHTS AND PRICES.

Brand.	1909.			1917.		
	Weight oz.	Cost cts.	Cost per lb. cts.	Weight oz.	Cost cts.	Cost per lb. cts.
Hominy	30	10	5.5	24	18	12
Hominy	31	6	3	74	43	9.5
Kellogg's Toasted Corn Flakes	10	10	16.0	8	11	22.0
Post Toasties	10	10	15.0	8	11	22.0
Quaker Toasted Corn Flakes	10	8	12.0	8	7	14.0
Quaker Yellow Corn Meal	46	12	4.0	24	12	8.0
Hornby's Oats	28	15	8.5	20	15	11.0
Quaker Oats	24	10	6.5	20	10	8.0
Quaker Puffed Rice	7.5	10	21.5	4	14	56.0
Cream of Wheat	28	15	8.5	28	22	12.5
Force	12	15	18.5	10	11	17.5
Grape-Nuts	16	12	12.0	13	13	16.0
Hecker's Farina	16	10	10.0	16	14	14.0
Holland Rusk	7	10	24.0	6	11	29.5
Malt Breakfast Food	30	15	8.0	28	22	12.5
Pettijohn's Breakfast Food	23	11	7.5	24	18	12.0
Premier Farina	16	10	10.0	16	14	14.0
Quaker Cracked Wheat	30	15	8.0	26	25	15.5
Saxon Wheat Food	25	15	9.5	26	22	13.5
Shredded Wheat	13	12	14.5	12	12	16.0
Triscuit	13	10	12.5	9.5	12	20.0
Wheatena	25	15	9.5	19	18	15.0
Ave. 6 corn products	..	..	**9.3**	..	..	**14.6**
Ave. 2 oat products	..	..	**7.5**	..	..	**9.5**
Ave. 13 wheat products	..	..	**11.7**	..	..	**16.0**
1 rice product	..	..	**21.5**	..	..	**56.0**

weight of the package has been reduced and in many instances the cost of the package increased. Hominy that in 1909 averaged 4 cents per lb. now costs 11 cents, corn flakes have increased from 14 to 19 cents, rolled oats from 7.5 to 9.5 cents, puffed rice from 21.5 to 56 cents, *Grape-Nuts* from 12 to 16 cents, farinas from 9.5 to 14 cents, cracked wheat from 8 to 15.5 cents and *Triscuit* from 12.5 to 20 cents per lb. Of the brands listed *Force* is the only one which costs no more per pound to-day than in 1909. On the average the corn products in the eight years advanced 57, oats 27, wheat 37 and rice 162 per cent. These startling increases emphasize the importance of intelligent buying of these widely used foods.

TABLE IV.

WEIGHTS OF ONE SERVING OF FOOD, CALORIES YIELDED, AND COST.

Food.	Weight of 1 cup (½ pint) of dry food.	Weight of one serving.	Total calories.	Per serving.	Per 100 calories.
	oz.	oz.		cts.	cts.
Corn.					
Corn flakes, Jersey	0.95	0.95	99	1.07	1.08
" " Kellogg's	0.78	0.78	76	1.07	1.40
" " Post Toasties	0.90	0.90	89	1.24	1.39
" " Quakers	*0.90	0.90	90	0.79	0.88
" " Washington Crisps	0.67	0 67	65	0.67	1.03
Corn meal, in bulk	5.40	1.62	163	0.71	0.44
" " Quaker	5.40	1.62	163	0.81	0.50
Corn puffs, Quaker	0.78	0.78	78	1.83	2.33
Hominy, Hecker's Cream	6.03	1.51	152	1.13	0.75
" Sunbeam	5.93	1.48	145	0.88	0.54
Roman Meal	5.40	1.62	161	1.00	0.63
Oats.					
Groats, Robinson's Patent	4.48	1.12	128	3.50	2.76
Oat Meal, in bulk	5.50	1.38	156	0.61	0.39
" " Bestovotes	4.76	1.19	128	0.74	0.58
" " Keen & Robinson's	5.54	1.39	156	1.91	1.22
" " McCann's	6.00	1.50	171	1.79	1.04
Oats, rolled, in bulk	2.50	1.25	140	0.55	0.39
" " Bufceco	2.68	1.34	145	0.67	0.46
" " Hecker's	2 68	1.34	142	0.67	0.46
" " Hornby's	*2 68	1.34	146	0.92	0.63
" " Leggett's	*2 68	1.34	142	1.01	0.71
" " Purity	2.68	1.34	140	0.67	0.46
" " Quaker	*2.68	1.34	144	0.67	0.47
" " Scott's	3.28	1.64	187	1.38	0.74
Rice.					
Rice, head, in bulk	7.00	1.75	175	1.31	0.75
" small, in bulk	7.00	1.75	175	1.09	0.63
" broken, in bulk	7.00	1.75	175	0.88	0.50
" flakes, Kellogg's	0.73	0.73	77	1.37	1.78
" puffed, Quaker	0.70	0.70	70	2.45	3.50
Wheat.					
Farina, Cream of Wheat	6.21	1.55	155	1.21	0.78
" Crystal Wheat	*6.05	1.51	154	1.37	0.89
" Hecker's Cream	*6.05	1.51	151	1.32	0.88
" Mother's Wheat Hearts	5.78	1.45	145	0.73	0.50
" Quaker (F. S.)	5.68	1.42	141	0.99	0.69
" Vitos	6.17	1.54	160	0.82	0.53
" Wheatena	*6.05	1.51	159	1.42	0.89
Wheat, cracked, Quaker	6.20	1.86	186	1.80	0.97
" flakes, Alber's	2.05	1.03	105	0.64	0.61
" flakes, Kellogg's	*0.78	0.78	82	1.46	1.78
" puffed, Quaker	0.53	0.53	54	1.99	3.62
Force	1.28	1.28	127	1.40	1.10

* Estimated from weight of similar preparations.

TABLE IV—*Continued.*

WEIGHTS OF ONE SERVING OF FOOD, CALORIES YIELDED, AND COST.

Food.	Weight of 1 cup (¼ pint) of dry food.	Weight of one serving.	Total calories.	Per serving.	Per 100 calories.
Wheat—Continued.	oz.	oz.		cts.	cts.
Grape-Nuts (4 heap. tablespoonfuls)	1.16	1.16	115	1.16	1.01
Kellogg's Krumbles	2.05	2.05	204	2.05	1.01
Pettijohn's Breakfast Food	*2.05	2.05	208	1.54	0.74
Ralston Wheat Food	4.80	1.20	121	1.13	0.94
Shredded Wheat (1 biscuit)	1.00	1.00	102	1.00	0.98
Triscuit (3 biscuits)	1.20	1.20	121	1.50	1.24
Miscellaneous.					
Fruit Nut Cereal	4.13	1.16	117	1.52	1.30
Post Tavern Porridge	5.68	1.42	141	0.89	0.63

* Estimated from weight of similar preparations.

SUGGESTIONS AS TO PURCHASE.

In order to make a fair comparison of cost we must not lose sight of the fact that many of these foods are served in the dry condition as purchased, while others, such as oatmeal, farina and hominy, during the cooking process absorb large amounts of water. It is obviously unfair, therefore, to compare the nutrient value of one pound of raw oatmeal with one pound of corn flakes. To obviate this difficulty Table IV has been prepared showing the weights in ounces of the average individual serving for most of these foods. In preparing this table the cup (½ pint) has been taken as the unit of measure, and it has been assumed that an average serving of corn flakes, corn puffs, rice flakes, puffed rice, wheat flakes, puffed wheat, *Krumbles,* and *Force,* is one cup, that of corn meal and cracked wheat 3/10 cup, of oatmeal, hominy, rice, farina and *Ralston Wheat Food* ¼ cup, of rolled oats and flaked wheat ½ cup, of *Shredded Wheat* 1 biscuit, of *Triscuit* 3 biscuits and of *Grape-Nuts* 4 heaping tablespoonfuls. In some cases these servings may be somewhat excessive but they are at least comparative. Where the food was available we have weighed one cupful in each case and the weights are shown in the table. In certain cases an assumed weight has been used based on the known weight of a similar preparation.

Table IV also shows the number of total calories yielded by these servings, as well as the cost per serving and cost per 100 calories.

The main facts in this table are shown graphically and perhaps more clearly in the charts on pages 40 to 43. The one chart shows the relative cost of the foods per serving, the other the relative cost per 100 calories. In the main these two charts show similar results, the differences arising not so much from variations in composition as from the variations in weight of servings of the respective foods. The serving basis is perhaps the more popular way to consider the cost of these foods, but the 100 calories basis is clearly the more exact and the more scientific. Our consideration, therefore, will be on the latter basis.

The relative cheapness of the uncooked cereals is apparent, oats and corn showing the lowest costs and rice and wheat the highest. The highest priced foods under each cereal (excepting *Robinson's Groats* already referred to), are the "ready-to-eat" preparations, and among these there is a wide range of cost. Of the flaked foods, corn flakes are the cheapest, followed by wheat and rice; the puffed cereals show about the same relative cost. The most obvious facts shown by the charts are the cheapness of the rolled oat preparations, and that corn puffs, puffed rice and puffed wheat are clearly among the luxuries of the breakfast table.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Barley Preparations.		
1913	Farwell & Rhines' Barley Crystals	9.9	1.3
1909	Quaker Scotch Brand Pearled Barley	12.1	0.9
	Corn (Maize) Preparations.		
1909	Cerealine	11.2	0.4
1909	E-C Corn Flakes, Toasted	12.1	0.3
1909	F. S. Granulated Hominy	13.3	1.0
1917	Hecker's Cream Hominy	11.7	0.4
1909	H-O New Process Hominy	11.3	0.3
1916	Jackson's Roman Meal	8.5	3.4
1917	Jersey Corn Flakes	7.7	0.3
1909	Kellogg's Toasted Corn Flakes	11.7	0.2
1909	Korn Kinks	12.0	0.4
1909	Nichols' Snow White Samp	13.4	0.3
1909	Post Toasties	11.7	0.3
1909	Quaker Best Yellow Corn Meal	12.3	0.8
1917	Quaker Corn Puffs	12.0	0.3
1909	Quaker Toasted Corn Flakes	11.6	0.4
1909	Ralston Hominy Grits	11.3	2.9
1909	Street's Perfection Hominy	12.4	1.3
1917	Sunbeam Pearl Hominy	14.3	0.6
1917	Washington Corn Crisps	12.1	0.2
	Oat Preparations.		
1917	Bestovotes	11.0	6.6
1917	Bufceco Rolled Oats	11.1	6.8
1909	Grandmother's Crushed Oats	10.7	6.5
1909	Health Brand White Oats	10.9	7.8
1917	Hecker's Cream Oat Meal	11.5	5.6
1909	Hornby's Steam Cooked Oat Meal	10.6	6.7
1917	Keen & Robinson's Granulated Scotch Oatmeal	10.4	9.1
1909	Leggett's Premier 15 Minute Oat Flakes	11.3	5.4
1917	McCann's Irish Oat Meal	9.2	8.7
1909	Mother's Crushed Oats	10.9	6.1
1909	Paw-Nee Rolled Oats	10.8	6.7
1917	Purity Rolled Oats	13.5	6.1
1909	Quaker Oats	10.8	6.0
1917	Robinson's Patent Groats	8.4	8.6
1917	Scott's Porage Oats	10.1	9.6
1909	Sovereign 15 Minute Oat Flakes	10.8	5.8
1909	White Rose Rolled Oats	10.3	8.0
	Rice Preparations.		
1915	Comet Cereal	11.3	0.3
1909	Cook's Flaked Rice	12.6	0.1
1909	Cook's Malto Rice	11.3	0.2
1915	Kellogg's Toasted Rice Biscuit	5.0	0.3

BREAKFAST FOODS.

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N×6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.9	11.5	1.2	75.2	62.7	410	.....	.....	.....	32*
0.3	9.5	1.0	76.2	69.2	401	.....	.....	.....	18*
0.1	6.9	1.5	79.9	60.2	401	.....	.....	.....	10*
0.2	6.6	2.2	78.6	61.3	393	.....	.....	.....	10*
0.2	8.0	0.4	77.1	75.7	399	.....	.....	.....	74*
0.5	9.8	0.3	77.3	71.2	402	18	12	0.75	24
0.2	8.0	0.4	79.8	74.4	404	.....	.....	.....	30*
5.0	13.3	3.7	66.1	37.4	398	25	10	0.63	40
0.3	8.5	0.9	82.3	64.7	418	10	18	1.08	9
0.2	6.4	2.7	78.8	55.5	392	11	22	1.40	8
0.1	7.4	2.2	77.9	66.3	394	.....	.....	.....	8*
0.5	7.8	0.3	77.7	78.2	394	.....	.....	.....	32*
0.2	6.6	1.8	79.4	53.9	396	11	22	1.39	8
0.2	7.5	0.5	78.7	75.7	402	12	8	0.50	24
0.1	8.7	0.4	78.5	43.2	402	14	37.5	2.33	6
0.0	6.8	1.3	79.9	68.3	398	7	14	0.88	8
0.4	9.0	1.0	75.4	70.9	416	.....	.....	.....	30*
0.1	7.9	0.4	77.9	74.5	406	.....	.....	.....	31*
0.3	9.4	0.4	75.0	70.8	392	43	9.5	0.54	74
0.2	7.8	2.9	76.8	59.5	389	10	16	1.03	10
1.0	16.2	2.1	63.1	55.1	430	17	10	0.58	24
1.0	15.1	2.0	64.0	55.6	432	10	8	0.46	20
0.6	14.9	1.9	65.4	59.1	434	.....	.....	.....	28*
1.0	13.8	2.0	64.5	58.8	438	....	....	....	32*
0.9	15.6	1.8	64.6	56.7	424	10	8	0.48	20
0.8	16.1	1.7	64.1	59.2	436	14	11	0.63	20
0.8	13.7	1.9	64.1	57.0	449	110	22	1.22	80
0.6	17.2	1.8	63.7	56.6	425	15	12	0.71	20
0.3	15.1	1.8	64.9	56.8	455	95	19	1.04	80
0.9	15.6	1.6	64.9	58.4	431	9	7	0.42	20*
0.8	15.8	1.9	64.0	59.7	434	.....	.....	.....	25*
1.0	16.3	2.0	61.1	57.4	417	10	8	0.48	20
0.9	15.9	1.9	64.5	56.7	429	10	8	0.47	20
0.7	12.8	1.8	67.7	60.5	456	50	50	2.74	16
0.4	13.3	1.7	64.9	56.8	456	25	13.5	0.74	30
0.9	16.5	2.0	64.0	58.0	428	....	....	....	34*
0.7	14.3	1.9	64.8	59.0	432	....	....	....	30*
0.2	7.2	0.3	80.7	....	405	....	....	....	16*
0.2	7.8	0.4	78.9	78.2	397	....	....	....	15*
0.1	7.6	0.6	80.2	74.1	403	....	....	....	17*
0.2	10.1	3.7	80.7	57.4	418	15	40	2.39	6

* Net weight of package at date specified in the first column.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Rice Preparations—Continued.		
1915	Kellogg's Toasted Rice Flakes	4.7	0.4
1909	Milk Rice	12.3	0.2
1909	Quaker Puffed Rice	12.2	0.2
	Rye Preparation.		
1915	Kellogg's Toasted Rye Flakes	8.1	1.5
	Wheat Preparations.		
1917	Alber's Wheat Flakes Mush	11.5	2.1
1913	Brusson Farine au Gluten	10.9	0.6
1910	Brusson Gluten Semolina	9.7	0.5
1915	Cero-Vita	4.6	0.7
1917	Cinnamon Rusks	9.9	7.2
1909	Cream of Wheat	13.1	0.9
1913	Cresco Grits	11.1	1.4
1914	Crystal Wheat	9.5	2.0
1914	Dieto Rusks	6.4	9.1
1909	Force	10.7	1.1
1917	F S Farina (Quaker Farina)	13.7	0.9
1909	Grandmother's A. & P. Farina	12.9	0.6
1911	Granola	6.1	0.8
1914	Granose Biscuit	11.3	1.6
1915	Granose Flakes	6.0	3.9
1909	Grape Nuts	10.3	0.6
1909	Hecker's Farina	12.7	0.7
1909	Holland Rusk	11.0	5.1
1914	Hoyt's Gum Gluten Breakfast Food	6.5	0.9
1914	Hoyt's Gum Gluten Granules	6.6	0.7
1913	Jireh Frumenty	6.2	1.7
1913	Jireh Whole Wheat Farina	6.2	2.3
1912	Kellogg's Breakfast Toast	7.7	1.9
1917	Kellogg's Krumbles	10.0	1.2
1915	Kellogg's Toasted Wheat Biscuit	5.8	1.4
1915	Kellogg's Toasted Wheat Flakes	5.2	1.1
1915	Kellogg's Zwieback	6.2	1.6
1909	Leggett's Premier Farina	14.1	0.9
1909	Malt Breakfast Food	9.6	1.5
1914	Manana Gluten Breakfast Food	7.6	2.0
1909	Mapl-Flake	10.8	1.2
1917	Mother's Wheat Hearts	13.5	1.1
1909	Pettijohn's Breakfast Food	10.3	2.0
1909	Pillsbury's Best Cereal	11.3	0.7
1909	Quaker Cracked Wheat	11.7	2.3
1917	Quaker Puffed Wheat	11.5	1.8
1909	Quaker Wheat Berries	9.8	2.0
1909	Ralston Health Food	12.4	1.7
1917	Ralston Wheat Food	11.9	1.8

BREAKFAST FOODS—*Continued.*

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N x 6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.2	10.0	3.4	81.3	55.7	422	15	30	1.78	8
0.2	6.9	3.2	77.2	62.6	387	....	....	....	8*
0.1	7.6	0.4	79.5	61.8	400	14	56	3.50	4
0.6	11.4	2.2	76.2	45.7	416	15	30	1.80	8
0.3	11.1	1.6	73.4	59.2	408	15	10	0.61	24
0.2	33.9	0.6	53.8	48.8	407	....	....	....	9*
0.3	17.2	0.7	71.6	64.9	411	....	....	....	30*
0.3	8.9	3.5	82.0	52.3	423	15	30	1.77	8
0.2	10.3	0.7	71.7	49.5	449	18	21	1.17	14
0.2	11.5	0.6	73.7	71.1	399	22	12.5	0.78	28
0.5	17.8	0.6	68.6	54.1	409	....	....	....	32*
1.7	11.3	1.9	73.6	....	408	20	14.5	0.89	22
1.0	15.9	1.5	66.1	52.1	469	60	76	4.05	13
1.1	10.6	2.8	73.7	59.9	397	11	17.5	1.10	10
0.2	10.2	0.4	74.6	63.9	397	10	11	0.69	14.5
0.1	10.8	0.6	75.0	71.7	398	....	....	....	16*
0.6	13.9	2.3	76.3	45.2	421	20	24.5	1.46	13
1.8	10.3	3.9	71.1	....	389	15	60	3.86	4
0.5	10.3	3.9	75.4	55.5	432	15	40	2.31	6
1.5	11.5	1.9	74.2	36.3	398	13	16	1.01	13
0.1	10.0	0.6	75.9	71.2	400	14	14	0.88	16
0.1	12.1	1.3	70.4	55.8	430	11	29	1.69	6
0.3	45.4	0.6	46.3	39.2	429	35	35	2.04	16
0.5	42.7	0.7	48.8	41.9	425	35	35	2.06	16
1.1	12.3	1.4	77.3	65.4	427	....	....	....	24*
2.2	12.9	1.8	74.6	59.5	424	....	....	....	24*
0.3	13.6	1.6	74.9	57.4	424	20	35.5	2.09	9
1.9	12.0	2.6	72.3	59.0	398	8	16	1.01	8
1.5	14.2	2.4	74.7	45.8	421	12	19	1.13	10
1.2	9.3	2.7	80.5	57.0	422	15	30	1.78	8
0.2	14.3	1.6	76.1	60.4	384	25	28.5	1.86	14
0.1	11.1	0.5	73.3	71.0	395	....	....	....	16*
1.0	13.8	1.4	72.7	53.5	411	22	12.5	0.76	28
1.7	42.6	2.5	43.6	29.9	415	25	40	2.41	10
1.2	9.3	2.8	74.7	58.3	396	....	....	....	11*
0.2	10.7	0.4	74.1	65.0	399	15	8	0.50	29
2.0	9.1	1.7	74.9	64.0	405	18	12	0.74	24
0.1	11.5	0.5	75.9	74.1	407	....	....	....	32*
1.7	9.3	1.7	73.3	63.6	401	25	15.5	0.97	26
1.6	13.1	1.8	70.2	29.5	399	15	60	3.76	4
1.2	14.0	1.4	71.6	57.1	412	....	....	....	8*
1.1	11.9	1.4	71.5	64.4	399	....	....	....	29*
0.8	11.3	1.1	73.1	62.8	404	22	15	0.94	24

* Net weight of package at date specified in the first column.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Wheat Preparations—Continued.		
1915	Sanitas Granuto	4.9	1.7
1909	Saxon Wheat Food	9.8	1.7
1909	Shredded Wheat Biscuit	8.5	1.4
1909	Street's Perfection Farina	13.1	1.1
1909	Triscuit	10.3	1.4
1917	Vitos	11.6	1.0
1909	Wheatena	10.4	2.8
1909	Wheatlet	12.2	1.6
1909	Zest	10.7	1.2
	Wheat Bran.		
1914	Ballard's Obelisk Sanitary Edible Bran	11.5	5.4
1917	Culp's Capitol Health Bran	11.2	4.3
1914	Health Food Co.'s Wheat Bran	11.6	4.1
1914	Jireh Wheat Bran	11.1	4.8
1914	Johnson's Educator Wheat Bran	11.6	4.7
1914	Kellogg's Sterilized Wheat Bran	9.6	5.2
	Wheat Bran Biscuit and other Laxative Preparations.		
1914	Bran Biskue	8.5	13.1
1917	Bran-eata Biscuit	9.8	0.9
1917	Bran Zos	11.9	2.5
1914	Brose Good Health Breakfast Food	10.1	4.3
1917	Cerag	9.2	0.9
1910	Cerena	7.2	11.4
1914	Christian's Laxative Bread	9.9	1.4
1909	Christian's Laxative Cereal Flakes	13.0	1.4
1914	Colax	13.1	0.8
1914	Dietetic Bran Biscuit	9.3	5.0
1914	Educator Bran Cookies	7.1	14.5
1914	Educator Bran Meal	11.8	2.8
1915	F. B. A. Laxative Health Biscuit	11.1	1.7
1917	Fruit Nut Cereal	7.3	1.2
1914	Good Health Biscuit (Kellogg)	10.9	1.2
1914	Health Food Wafers	9.7	7.9
1917	India (Digestive) Biscuit	8.7	2.2
1915	Laxa	6.6	2.8
1914	Laxative Biscuit (Kellogg)	9.4	10.8
1914	Mansfield's Agar Agar Wafers	7.9	12.0
1914	Oval Digestive Biscuit (H. & P.)	8.8	16.3
1915	Uncle Sam Health Food	6.3	24.4
1917	Zim	13.2	1.7
	Miscellaneous Preparations.		
1914	Dieto Nut Cereal	5.0	18.4
1914	Dieto Wheat and Barley Cereal	6.8	2.2
1906	Jireh Wheat Nuts	7.6	15.6

BREAKFAST FOODS—*Continued.*

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N x 6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.4	10.1	1.3	81.6	43.4	437	20	23	1.32	14
0.5	12.8	0.8	74.4	69.6	416	22	13.5	0.81	26
2.6	11.0	1.5	75.0	63.1	408	12	16	0.98	12
0.1	10.3	0.5	74.9	71.1	401	....	....	....	16*
1.7	11.0	1.7	73.9	60.8	403	12	20	1.24	9.5
0.2	11.1	0.5	75.6	68.7	417	15	8.5	0.51	28
0.6	11.3	0.7	74.2	69.8	420	18	15	0.89	19
0.3	12.8	0.8	72.3	66.2	406	....	....	....	28*
1.2	9.0	2.6	75.3	60.1	398	....	....	....	11.5*
5.6	17.3	4.5	55.7	....	390	25	9.5	0.61	42
8.2	13.4	5.3	57.6	....	369	15	8.5	0.58	28
8.2	14.3	5.6	56.2	....	364	10	12.5	0.86	13
6.3	16.8	4.3	56.7	....	385	10	6.5	0.42	24
7.8	15.4	6.1	54.4	....	368	15	12	0.82	20
8.5	16.3	6.0	54.4	....	377	25	23.5	1.56	17
2.2	12.1	3.1	61.0	....	469	15	15	0.80	16
3.6	9.1	4.4	72.2	21.0	381	15	24	1.57	10
3.8	13.2	3.0	65.6	46.2	386	15	12	0.78	20
3.1	14.4	2.6	65.5	....	410	20	20	1.22	16
2.0	11.3	3.6	73.0	20.8	....	15	24	....	10
2.4	27.8	4.9	46.3	25.1	456	25	25	1.37	16*
1.3	10.0	2.8	74.6	....	401	25	30	1.87	13*
1.0	10.4	1.7	72.5	61.2	393	....	....	....	21*
0.1	1.1	2.1	82.8	....	....	100	26.7	....	6
1.7	9.9	5.0	69.1	....	413	25	38	2.30	10.5
1.5	8.9	3.3	64.7	....	486	25	50	2.57	8
3.8	12.3	2.9	66.4	....	389	20	7.5	0.48	42
0.7	6.1	3.1	77.3	....	398	....	....	....	....
2.4	13.5	3.2	72.4	36.5	405	15	21	1.30	11
1.5	7.7	4.2	74.5	....	389	15	40	2.57	6
1.4	10.0	5.3	65.7	....	427	15	17.5	1.03	13.5
5.2	12.8	5.0	66.1	....	383	25	33	2.15	12
6.6	12.4	5.0	66.6	....	....	50	106	....	7.5
2.4	16.7	3.0	57.7	....	451	....	....	....	3
0.8	7.1	2.3	69.9	....	475	23	73.5	3.87	5
0.5	7.8	2.1	64.5	....	499	15	30	1.50	8
4.0	21.3	3.1	40.9	....	538	28	25	1.16	18
1.5	7.4	2.0	74.2	6.2	391	15	20	1.28	9
1.2	21.6	2.0	51.8	39.5	525	30	34	1.62	14
2.0	11.6	1.7	75.7	61.4	410	....	....	....	36*
1.0	19.0	2.3	54.5	50.1	496	30	30	1.51	16

* Net weight of package at date specified in the first column.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Miscellaneous Preparations—Continued.		
1917	Malabar Manoca	13.3	0.1
1917	Post Tavern Porridge	12.7	0.8
1913	Post Tavern Special	9.9	1.1
1917	Sea Moss Farina	15.6	0.3
1917	Sunbeam Tapioca	13.5	0.1
1913	Trix	6.2	0.2

It appears from the facts given in this bulletin that cereal breakfast foods can be bought uncooked, partially cooked, or ready to serve. The difference in prices between the three kinds is in some cases very great, but in others so little that their extra cost probably is not more than the cost of fuel which would be used for cooking the raw meals.

The greater popularity of wheat foods is indicated by the fact that 48 wheat foods, besides 29 wheat laxative preparations have been found in one market, 18 of corn, 17 of oats, 7 of rice, 2 of barley and 1 of rye.

Attention is called to the relative food value and cost of these preparations and the more general use of oat and corn foods is suggested.

OATMEAL and "ROLLED OATS," sold in bulk or in various package forms, are the most nutritious and, considering their food value, the cheapest of the cereals. The uncooked oat preparations sell generally now for from 7 to 12 cents a pound. They contain from 1½ to 2 times as much protein, 3.9 times as much fat and 120 more calories—or heat producers—per pound than other commonly used cereals, and the ratio of protein to non-protein calories is what is required in a complete ration.

WHEAT, CRACKED or FLAKED, is, next to oats, the richest in protein, but one of the most expensive cereal foods. A very large number of preparations made from wheat are on the mar-

BREAKFAST FOODS—*Concluded.*

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N x 6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.6	0.6	1.3	84.1	....	388	22	22	1.42	16
0.2	10.3	1.5	74.5	67.2	396	18	10	0.63	28
0.3	10.9	0.9	76.9	69.3	413	14	8	0.48	28
1.5	9.1	13.6	59.9	....	....	30	120	....	4
0.1	0.6	0.2	85.5	....	396	20	20	1.26	16
0.3	14.5	1.5	77.3	48.6	422	15	16	0.95	15

* Net weight of package at date specified in the first column.

ket, none of them probably superior, considering both cost and composition, to plain cracked wheat (easily made at home by crushing whole wheat very coarse in a coffee mill).

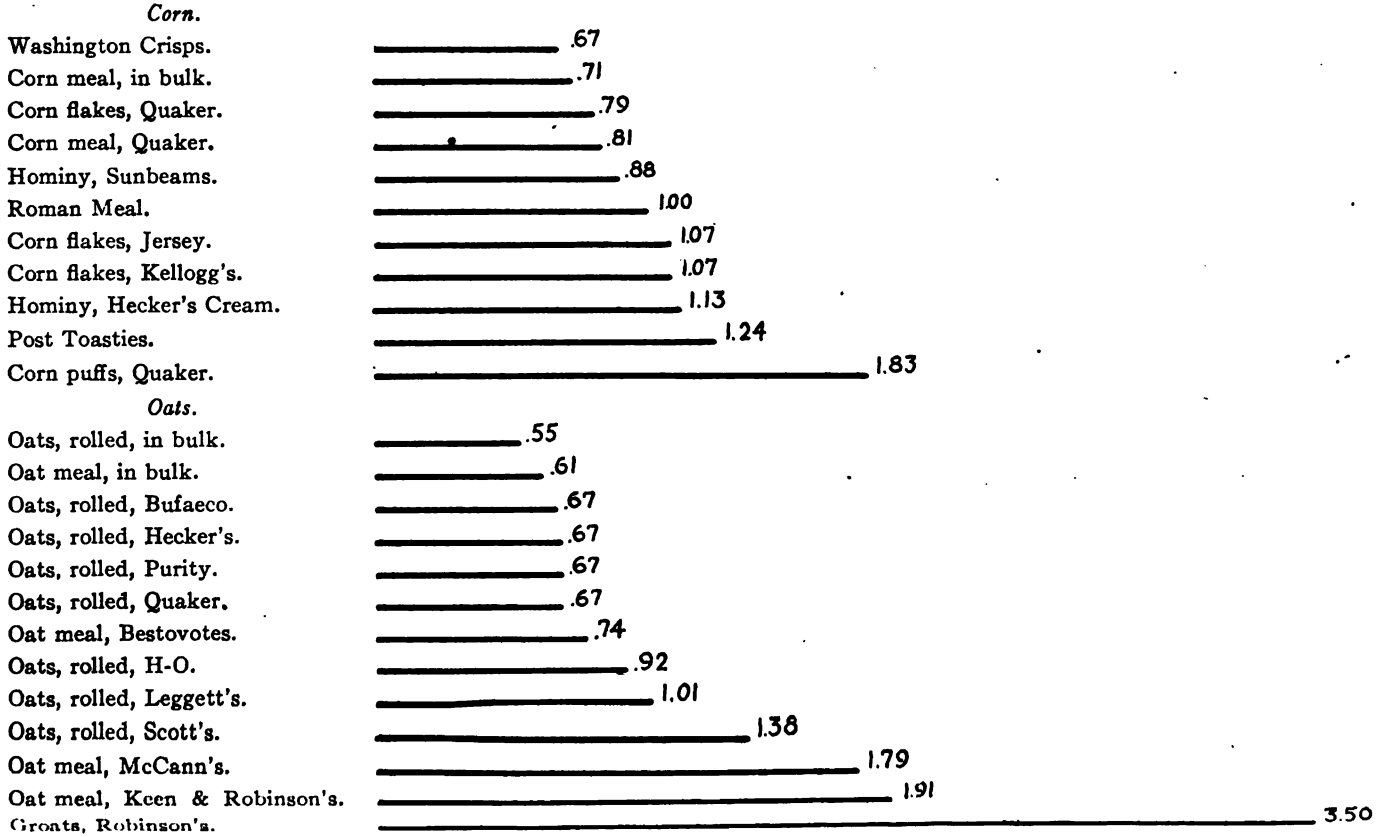
CORN PRODUCTS, such as MEAL, FLAKES, HOMINY and SAMP, all have about the same composition and nutritive value. They are inferior in nutritive value to either wheat or oats, while their average cost at present is greater than that of oat products.

RICE GRAIN, RICE FLAKES and PUFFED RICE, have less protein and fat than any other cereal, have about the same heat value as corn or wheat products and at present are relatively very expensive.

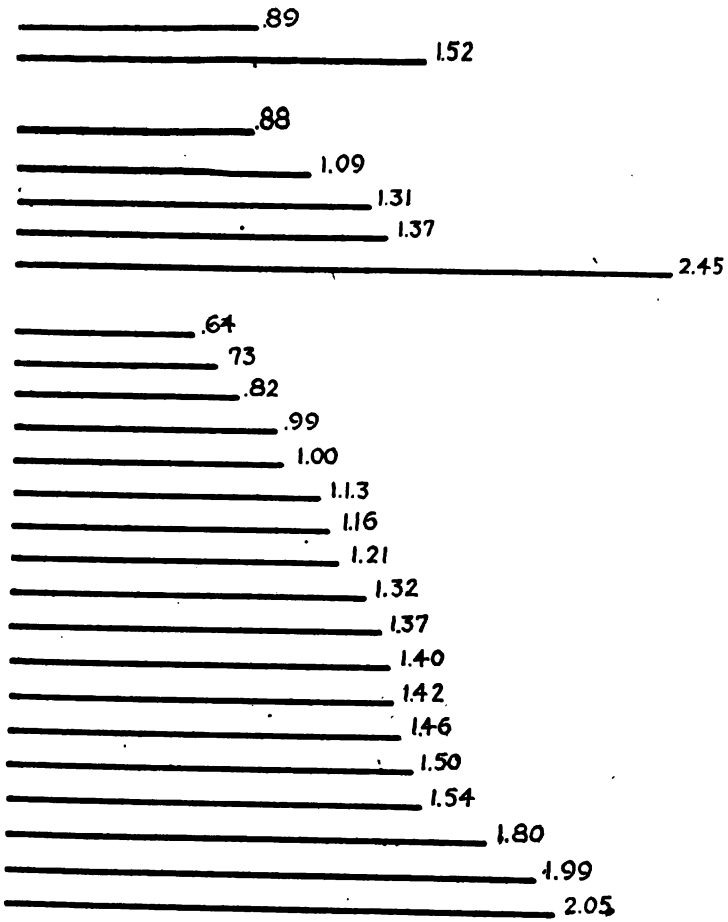
It is clear that oats used as a breakfast cereal, not only conserves wheat, but furnishes a richer food at a lower price. The other cereals, corn and rice, one cheap, the other expensive, have about the same fuel value as wheat, but generally contain less protein or flesh-forming material. Wheat is, however, the most generally satisfactory cereal food. Some people cannot constantly use corn meal as a breakfast food without digestive trouble, but occasional use of it furnishes acceptable variety. Oats are much more generally satisfactory for constant daily use.

All the grain preparations require long cooking; three hours in a double boiler is not too much, and this will naturally be done at any time in the day when the stove is being used for other purposes as well.

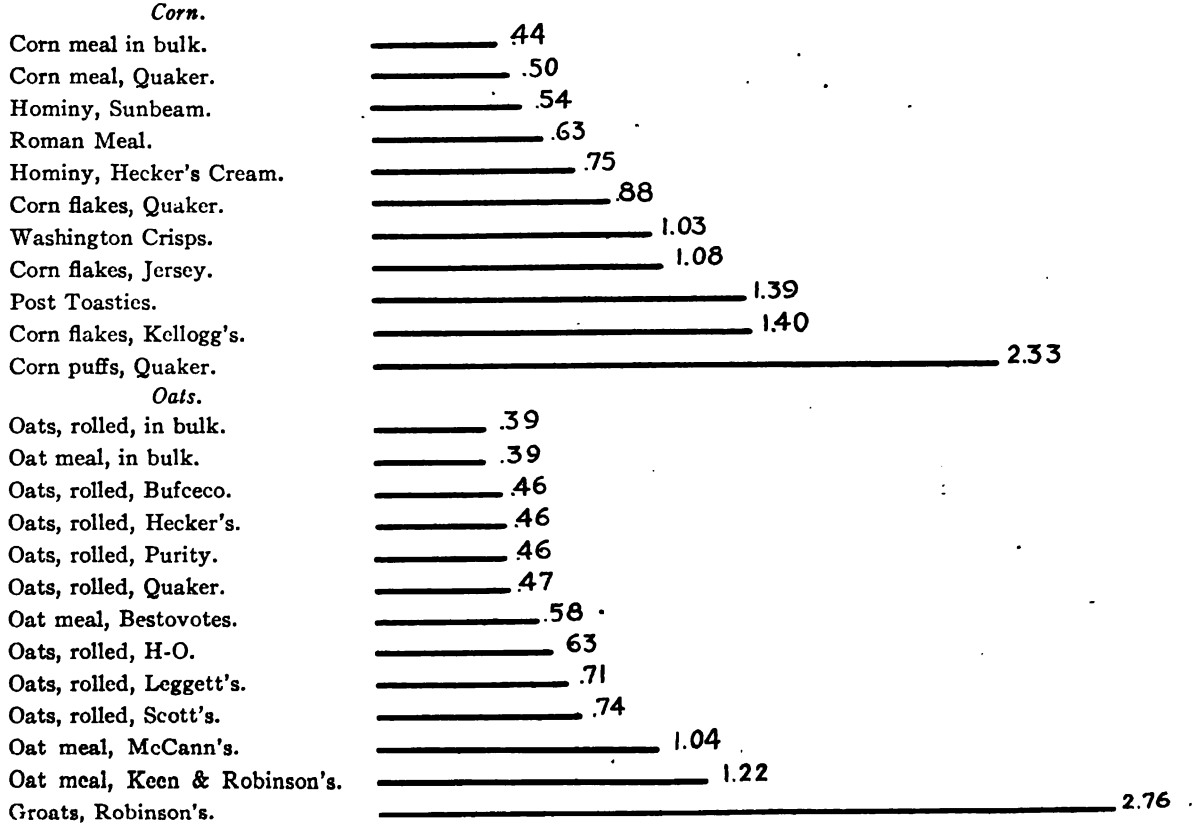
RELATIVE COST OF BREAKFAST FOODS PER SERVING (IN CENTS).



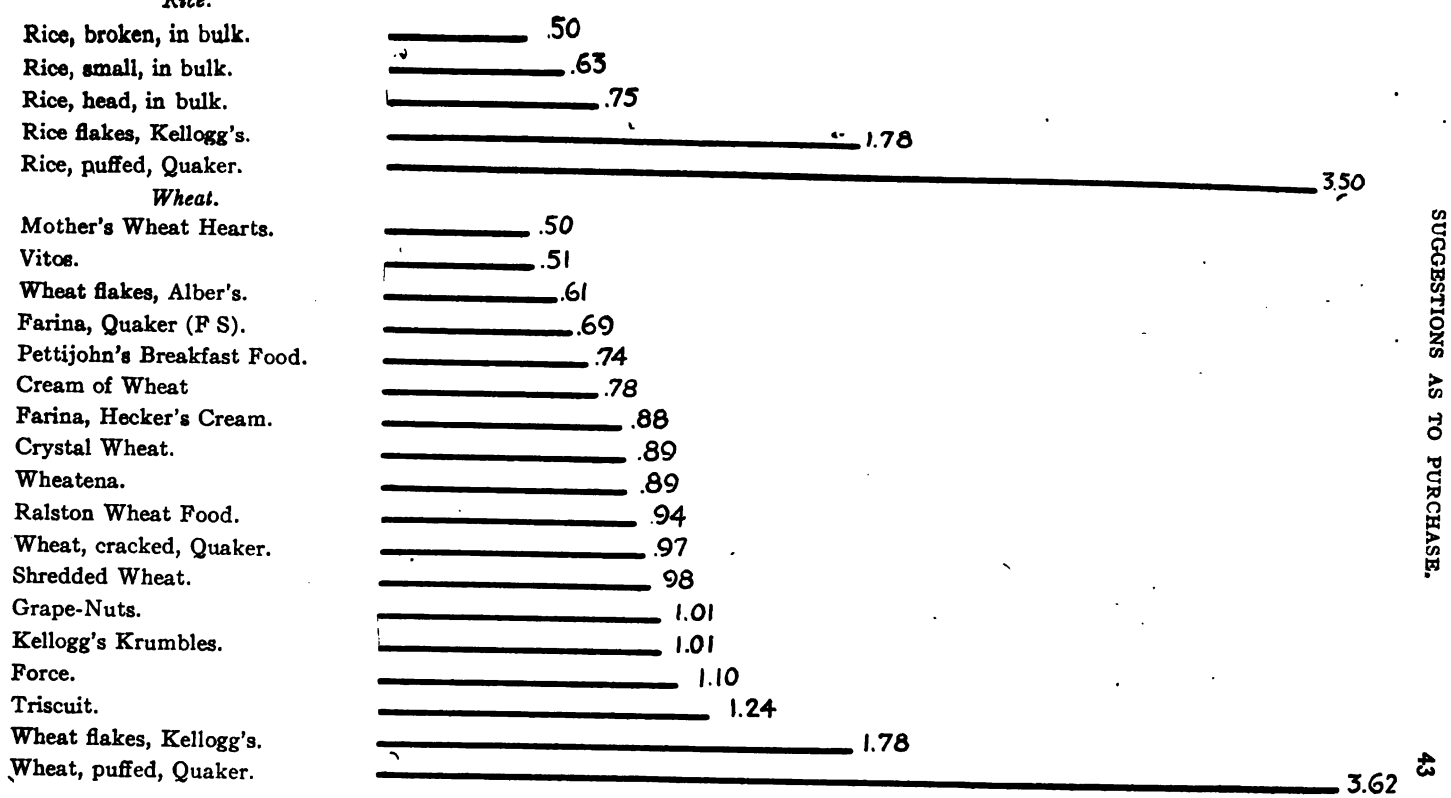
Miscellaneous.



RELATIVE COST OF BREAKFAST FOODS PER 100 CALORIES (IN CENTS).



RELATIVE COST OF BREAKFAST FOODS PER 100 CALORIES (IN CENTS)—*Concluded.*



Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 198 NOVEMBER, 1917

Domestic Supplies of Potash

By E. H. JENKINS

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Domestic Supplies of Potash.

There is practically no commercial supply of potash salts which can be used to profit by farmers, and probably there will be no adequate supply while war lasts. A brief notice of the domestic supply, chiefly of various kinds of ashes, may, therefore, be helpful.

"Canada Hardwood Ashes."

The following statement shows the average composition of the so-called Canada Hardwood Ashes offered in Connecticut during the periods named, as determined by our analyses:

		Contained in the ashes, per cent.			
Period	No. of analyses	Water-soluble potash	Phosphoric acid	Lime	Valuation per ton*
1903 to 1906	72	4.74	1.35	30.00	$10.65
1907 to 1910	49	3.78	1.42	27.31	8.99
1911 to 1917	23	2.77	1.15	23.80	6.96

The figures show that Canada Ashes have decreased steadily in quality and value since 1900.

The average shipment of Canada Ashes at present has only two-thirds the value of the average shipment ten years ago. Many shipments are even less valuable and are neither hardwood ashes, nor even wood ashes in any fair meaning of the term. The reasons for this are variously given, but the fact, which alone concerns us, is indisputable. Unless buyers make a hard and fast agreement to pay on the basis of water-soluble potash, with a specified rebate for any deficiency, and have their shipments carefully sampled and analyzed, there can be no certainty of economy in their purchase.

Ashes From Household Fires.

The average of all our analyses of household wood ashes produced in this state shows 5.99 per cent. of water-soluble potash, 2.68 per cent. of phosphoric acid and 33.58 per cent. of lime; the extremes of potash being 2.93 and 7.51 per cent. The wide differences in composition are due partly to differences in the ash-content of the wood, partly also to the heat of burning. If the

* Based on values which obtained a few years ago; viz., potash as carbonate 7.7 cents and phosphoric acid 3½ cents per pound; lime 40 cents per 100 pounds.

heat is intense and long continued, especially if sand or earth adheres to the wood, more or less potash combines with silica and becomes insoluble.

A bushel of dry ashes from the stove or fireplace weighs about 48 pounds and may contain about 2.9 pounds of potash, 1¼ pounds of phosphoric acid and 16 pounds of lime, which, with the present prices of potash, would be worth 80 cents or more.

Seventeen hundred pounds, or about 35½ bushels, contain as much soluble potash (50 pounds) as 100 pounds of muriate of potash and in more desirable form, besides 45 pounds of phosphoric acid and 570 pounds of lime, in form of fine carbonate. No better fertilizer for clover or other legumes can be suggested.

Of course, these figures are only approximate, but show the wisdom of carefully collecting and saving in a dry place *all* the wood ashes from stoves and fireplaces, for use in garden and field. They are too often wasted by mixing with coal ashes, which are comparatively worthless, or thrown with wastes to be carted off to a dump.

Too much cannot be said of the value of the "open fire" in the house, whether in city or country. Aside from its value for heating and ventilation, it should be more used than it is as a "destructor" for many kinds of wastes, recovering from them the most of what has any value. A hot fire will dry and consume, with no annoyance, much of the kitchen waste of the day, or if the waste is buried at night in the hot ashes, it will dry and be consumed in the next fire. Besides the satisfaction of not burdening others with one's own waste, there is satisfaction in the saving of some valuable material which would otherwise be lost. While the amount of potash in the wastes themselves is relatively very small, the per cent. of potash in *their ashes* is, in some cases, surprisingly large. For example, recent tests at this station show the following percentages of potash and phosphoric acid in the *ashes* of certain common vegetable wastes:

	Potash	Phosphoric acid
Apple parings	11.74	3.08
Banana stalks, yellow	49.40	2.34
" " red	46.64	3.04
" skins	41.76	3.25
Grape fruit skins	30.64	3.58
Lemon skins	31.00	6.30
Orange skins	27.04	2.90

	Potash	Phosphoric acid
Peanut shells	6.45	1.23
Potato peelings	27.54	5.18
Corn cobs	17.25	3.14
Cigar ashes	16.81	2.57

There are other wastes which have very little potash in their ashes. Among these are:

	Potash	Phosphoric acid	Lime
Egg shells	0.29	0.43	52.12
Dry leaves	0.51	0.38	1.58

The Ashes of Corn Cobs.

The percentage of potash in corn cobs is quite small, about 0.45 per cent., but the ashes of corn cobs which are sometimes available where corn is shelled on the farm are a source of potash worth considering. An analysis made here some time ago showed:

Water-soluble potash	21.13%
Phosphoric acid	4.01

Ashes from Brush Heaps.

When land is cleared for cultivation or pasture, or extensive orchard pruning and cutting of worthless trees has been done, the ashes from the brush heaps will probably have nearly the same composition as that of those produced in witch-hazel factories. (See below.) Canadian analyses show 10.3 per cent. of potash in the ashes of blackberry canes, 13 per cent. in those of gooseberries and 7.9 in those of raspberries. The effect of these ashes is often seen for years in increased production on spots where brush was burned.

Salt Marsh and River Meadow Hay as a Source of Potash.

While no one would think of burning salt marsh hay for the potash in it, we call attention here to its composition, to show that the use of the herbage from salt marshes, either for feed or for litter, brings very considerable amounts of potash, as well as other plant food, to the land from the sea. Analyses made here some years ago showed that the following quantities (expressed in pounds) of plant food were carried to the farm from the salt marsh per ton of hay of the kinds named:

	Nitrogen	Phosphoric acid	Potash
Black grass (*Juncus gerardi*).....	23.8	5.0	42.0
Salt grass (*Spartina juncea*).....	17.4	5.4	14.0
Three-Square (*Scirpus americanus*).....	23.8	5.0	30.2
Creek sedge (*Spartina glabra*).....	21.8	7.4	21.2

Hay from these grasses carries besides from 12 to 90 pounds of salt, or an average of 54 pounds per ton.

Small fruits, such as raspberries and currants, which are abundantly mulched with marsh grasses, scarcely need other fertilizers, and the coarser grasses should be used abundantly as litter and composted with manure.

River meadows, where the tall "bent" grasses grow every year with no fertilizer other than that supplied in the spring freshets, yield about as much nitrogen and phosphoric acid, but less potash than the marsh grasses. The following figures from one of our previous reports show this.

In one ton of hay of the grasses named are the following number of pounds of the three plant foods under discussion:

	Nitrogen	Phosphoric acid	Potash
Black bent (*Panicum virgatum*).....	29	7	10
Blue bent (*Andropogon provincialis*).....	21	6	11
Indian grass (*Sorghastrum nutans*).....	20	10	19
Poverty grass (*Andropogon scoparius*)...	11	5	11

Ashes From Brick-Kilns.

In normal years about two hundred million brick are made in Connecticut, but in 1916 and 1917 probably not more than half or two-thirds of that number yearly, because of bad weather and scarcity of labor. From 200 to 250 cords of woods are used in burning a million brick, so that this year's consumption of wood in Connecticut brick-kilns will be at least 22,500 cords. If the wood weighs 3,250 pounds per cord and contains 0.75 per cent. of ash, with 6 per cent. of potash in the ashes, the total amount of potash contained in the wood burned would be 16.45 tons; as much as is contained in 32.9 tons of muriate of potash.

The actual yield of water-soluble potash from the ashes which can be raked from the kilns after firing is, however, quite disappointing. This is explained by the facts that a part of the ashes is carried away by the strong draft and scattered through the kiln or into the air and that the intense heat fuses the carbonate of potash with the silicate in the clay and makes much of it insoluble in water and a part insoluble even in acids.

Six analyses of brick-kiln ashes gave us an average of 1.58 per cent. of potash and 1.70 of phosphoric acid.

A careful test which we made at the brick-kilns of Stiles & Son, at North Haven, with the kind co-operation of the owners, gave the following result: The kiln had 26 arches and contained about 780,000 brick. Three of the arches were raked clean. The screened ashes weighed 388 pounds, or 3,362 pounds for the kiln. The amount of wood burned in the kiln was, approximately, 182 cords, so that a cord of wood left 18.5 pounds of ashes in the arch. The ashes contained

	Per cent.
Total acid-soluble potash	2.44
of which, water-soluble	1.30
Lime	37.42
Magnesia	3.84
Phosphoric acid	1.91
Moisture	0.16

A cord of wood such as is burned there is stated to weigh about 3,250 lbs. The amount of pure ash in it will not be far from 24.4 lbs., containing perhaps 1.5 lbs. of potash. But apparently, there was recovered in the kiln ashes only 0.45 lbs., or less than one-third, in acid-soluble form.

Ashes From Factories.

Witch-Hazel Stills. There are five or more factories in this state where witch-hazel, or black birch, brush is distilled. The brush is then burned to make steam. When coal is not used with the brush, the ashes are of excellent quality, as appears in the following analysis, made some time ago:

	Per cent.
Total potash	5.09
Water-soluble potash	4.61
Phosphoric acid	4.52
Lime	37.75
Magnesia	4.68

An analysis of the ashes, recently made, showed 4.47 per cent. of water-soluble potash and 4.95 of phosphoric acid.

Brass Mills. Four analyses of the ashes of wood used in muffles at the brass mills of this state contained the following percentages:

	Average	Extremes
Water-soluble potash	4.35	2.9— 6.1
Phosphoric acid	2.64	1.9— 3.4
Lime	36.00	25.4—47.4

Smoke-House. Corn cobs or hickory wood have been most commonly used on farms for smoking meats. The average of three analyses is

	Per cent.
Total potash	7.72
Phosphoric acid	1.48
Lime	41.78

The Ashes of Seaweeds.

The burning of kelp and other seaweeds, for the extraction of potash, iodine and bromine, has long been practiced on the coasts of the British Isles. It has not, to our knowledge, been done to any extent in this country.

The analyses of seaweeds in our Bulletin 194 show that the *pure* ash of kelp and rockweed may contain not far from 9 per cent. of potash, and that of the eel-grass only 3 per cent.

For farm use there is probably no economy in drying and burning seaweeds for the sake of the potash. It will probably pay better to haul wet rockweed or kelp directly to the land, and eel-grass, after draining and drying, to the pig-pen or cow stables for litter, as suggested in the Bulletin.

The Potash in Farm Manure.

Farm manure is commonly regarded as distinctly a nitrogenous manure, for its nitrogen content proclaims itself in various ways. But manure contains as much potash as nitrogen and often more, and more than one-half of this potash is contained in the urine. The same is true of the nitrogen. Yet on many farms the liquid manure is allowed to run to waste, or at any rate no great pains are taken to absorb and hold it. More attention is paid to the solid than to the liquid part of the manure.

There would be less loss of fertilizer value if all of the urine were saved and litter and dung thrown away than if all the solids of the manure were saved and all the liquid wasted.

The value of manure depends both on the character of the feed and on the meat or milk production of the animals.

A ton of farm manure from cows, hogs or steers will contain on the average from 9½ to 13 pounds of potash. It may contain considerably more if pains are taken to prevent any loss of liquid.

Connecticut Agricultural Experiment Station

E. H. JENKINS, Director

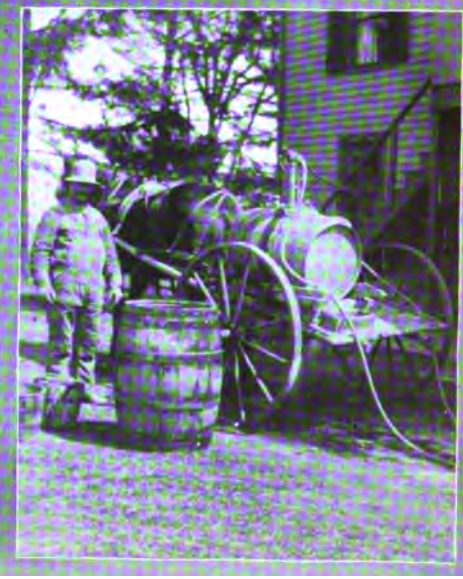
NEW HAVEN, CONN.

PRAY CALENDAR

W. E. BRITTON, Entomologist

BULLETIN 199

G. P. CLINTON, Botanist



DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

3 lbs. (Paste) or 1½ lbs. (Dry) Lead Arsenate.
50 gals. Water.

Spray upon foliage to kill all chewing insects. May be used with Bordeaux or with lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime.
100 gals. Water.

Spray upon foliage to kill potato beetle, elm leaf beetle, and all chewing insects. Commonly used with Bordeaux mixture.

POISONED BRAN MASH.

5 lbs. Wheat Bran. 4 oz. White Arsenic or Paris Green.
1 pt. Cheap Molasses. 1 Lemon. 7 pts. Water.

Scatter around in field to kill cut-worms, army worms and grasshoppers.

HELLEBORE.

Dust on the plants, or mix with water, 1 oz. in 2 gals. and spray. For currant-worm and other saw-fly larvae.

COMMERCIAL LIME-SULPHUR.

Winter Spray.

1 part lime and sulphur. 9 parts water.

Summer Spray.

1¼ to 1½ parts lime and sulphur. 45 to 50 parts water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

NICOTINE SOLUTION.

½ pint in 50 gals. Water.

Several solutions are now sold containing 40% or more of nicotine. Excellent for killing aphids and other sucking insects. Add soap for a spreader.

KEROSENE EMULSION.

2 gals. Kerosene. ½ lb. common soap.
1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn together with pump until a white creamy mass is formed which thickens on cooling. Dilute nine times before using.

MISCIBLE OILS.

Several miscible oils are on the market, such as "Scalecide" and "Jarvis Compound." Are used to kill San José Scale, especially on old apple trees. Should be mixed 1 part in 15 parts water.

COMMON SOAP.

1 lb in 8 gals. Water.

Spray upon foliage to kill red spider, aphids and other sucking insects.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for about 40 bushels of grain. Expose for about 36 hours.

NAPHTHALENE.

Used in the form of moth-balls and "flakes" to keep clothes moths out of clothing. "Flakes" scattered around the borders of floors and shelves will drive away ants.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin.
½ cup Sweet Milk. ½ cup Water.

Mix together and expose in a shallow plate with a slice of bread in it. Flies will drink the liquid, especially if no other moisture is accessible, and be killed.

HYDROCYANIC ACID GAS.

1 oz. Potassium Cyanide.
2 oz. Sulphuric Acid. 4 oz. Water.
For each 100 cu. ft. space.

For dormant stock place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space.

FORMULAS FOR COMMON FUNGICIDES.

COMMERCIAL LIME-SULPHUR.

Winter Spray.
1 part lime and sulphur. 9 parts water.
Summer Spray.
1¼ to 1½ parts lime and sulphur. 45 to 50 parts water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

BORDEAUX MIXTURE.

4 lbs. Copper Sulphate.
4 lbs. Fresh Lime. 40 to 50 gals. Water.

Dissolve the copper sulphate in hot water or from a coarse bag suspended in cold water; slake the lime separately and strain. Dilute the latter to about 20 gals., into which pour the copper sulphate, diluted to about 20 gals., stirring the mixture; dilute further to form the forty-five or fifty gallons; or dilute each to 25 gals., and pour together into barrel. Stock solutions of the copper sulphate and lime, rate 1 lb. to 1 gal. water, can be made separately and used as needed.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime.
8 lbs. Fine Sulphur. 45 to 50 gals. Water.

Start the lime slaking, sift and thoroughly stir in the sulphur, using just enough water to prevent burning and allow to boil from heat of lime for fifteen minutes. Then dilute and apply.

FORMALIN.

A. 1 pt. (1 lb.) Formalin in 50 gals. water, for sprinkling grain to kill smut.

B. 1 pt. Formalin in 30 gals. water, for soaking tubers to prevent potato scab.

C. 1 pt. Formalin in 12½ gals. water, for soil treatment. Use two-thirds to 1 gal. for each square foot of surface treated; cover for 24 hours after treatment; air afterwards, and stir soil; allow 7-10 days before seeding and 10-14 days before transplanting in this soil.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. copper sulphate, 4 of lime, and make as above directed. For second and third sprayings of apples to lessen russeting of the fruit.

Soda Bordeaux Mixture. 4 lbs. copper sulphate, 1⅛ to 1½ lbs. soda lye, 50 gals. water. Use only enough lye to make the solution alkaline to test paper. Used sometimes for late spraying of grapes, etc., where spray sediment is objectionable.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil over fire, cool slightly, add 1 lb. soda lye, stirring. Add 5 gals. water and boil till the mixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux mixture. Used sometimes on such glaucous plants as asparagus, cabbage, onions, etc., to make a more adhesive spray.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

AMM. SOL. COP. CARBONATE.

5 ozs. Copper Carbonate.
3 pts. Ammonia. 45-50 gals. Water.

Use *just enough* ammonia (if strong, dilute with several volumes of water) to dissolve the copper carbonate; then dilute to final volume. This fungicide is not as good as Bordeaux, but is used to avoid sediment on the foliage or fruit.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometimes used on foliage. Now rarely used.

COPPER LIME-SULPHUR.

2 lbs. Copper Sulphate.
1½ gals. Com. Lime-Sulphur. 45-50 gals. Water.

Dissolve copper sulphate in part of the water, and then add with the lime-sulphur to the remainder. Apparently a good fungicide but likely to russet apples as does strong Bordeaux.

SULPHUR MIXTURE.

Various commercial forms of Sulphur as "Atomic Sulphur" and "Sulphur Paste," have fungicidal value, and have been used by us for summer spraying of peaches with little or no injury, at the rate of 8 lbs. to 45-50 gals. of water.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them. To prevent injury to potatoes, fill space at rate of 167 bu. Place Formalin in large pail in cleared central space and drop in the crystals of potassium permanganate. Close room air-tight for 24 to 48 hours.

INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

Insects, etc.

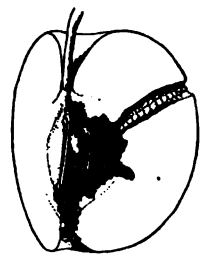
APPLE.

Bud-Moths: Case Bearers: Leaf Crumpler:—Small overwintering caterpillars feed upon the unfolding leaves. Spray with lead arsenate as soon as leaf buds begin to open. Repeat a few days later, if necessary. Rept. 1909, p. 353.

Canker-Worms—During May small looping caterpillars devour the leaves and spin down on threads when disturbed. Spray foliage with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards sticky tanglefoot bands should be placed around trunks of trees in October, kept sticky until January 1st, and again kept sticky during April and May. Rept. 1908, p. 777.

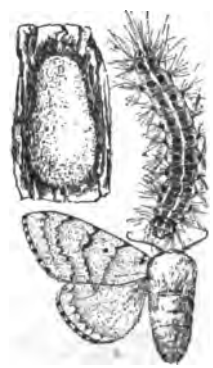
Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before the blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.

Lesser Apple Worm—Larva feeds on exterior of nearly mature fruit, and often causes injury in storage. Spray as for Codling-Moth. Rept. 1910, p. 595.



Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three or four weeks later. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 594.

Brown-Tail Moth: Fall Web-Worm—See Pear.



Gipsy Moth—Occurs in the United States only in south-eastern New England. Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot, and with burlap, which should be examined each day to destroy caterpillars. From August to May egg-masses can be destroyed by soaking them with creosote. Spray foliage with lead arsenate. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300; also placard.

Curculios—Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray twice after blossoms fall as for Codling-Moth, and remove infested fruit in thinning. Rept. 1904, p. 219.

Green Fruit Worms: Palmer Worm: Leaf Roller—Caterpillars all feed upon foliage and immature fruit. Spray with lead arsenate, as for Codling-Moth.

Tussock Moths—Tufted caterpillars of several species feed upon the leaves in mid-summer. Spray with lead arsenate as for Codling-Moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in clusters and often strip young trees in fall. Hand-picking is easy method of control. Spray leaves with lead arsenate. Rept. 1901, p. 274.

Maggot or **Railroad Worm**—Maggots tunnel through the pulp of the ripening fruit of sweet and sub-acid varieties, especially those ripening early in the season. Destroy all infested fruit. Rept. 1910, p. 593.

Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

Leaf Hoppers—Whitish insects sucking sap from underside the leaves. Spray with nicotine solution, as for aphis.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray with nicotine solution as for aphis.

Red Spider: Clover Mite—Cause much injury to leaves, especially in dry seasons. Spray with kerosene emulsion or nicotine solution as summer treatment. Eggs of latter species killed by lime-sulphur spray in winter.

Leaf-Blister Mite—See Pear.

Green and **Rosy Aphids**—Green aphids suck sap from the leaves and terminal shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Spray with nicotine solution (½ pint in 50 gallons water), either separately or in combination with lead arsenate, lime-sulphur or Bordeaux Mixture. Repts. 1903, p. 259; 1909, p. 343.

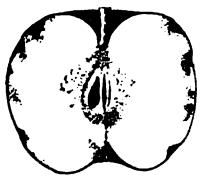
San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.

Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphis.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying small feeding roots. Plant only clean or fumigated stock. Use tobacco dust in soil around trees. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color as the bark, the latter light gray or whitish. Spray with nicotine solution; soap and water; or kerosene emulsion, about the second week in June. Bull. 143; Rept. 1903, p. 225.

Fungi, etc.



Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous, but apparently a physiological disease. Thought by some to be due to unusual local loss of water; possibly may start from punctures of Rosy Aphis or similar puncturing insects. No remedy known.

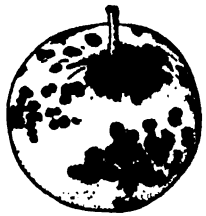
Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark, which each year is killed a little further, adding another ridge. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

Black Rot—Causes mature fruit to rot, eventually turning it black; forms small brown spots on leaves; does some damage through cankers on branches, which are eventually killed. Treat as for Scab; prune and burn all dead limbs and twigs; cut out and paint over large cankers when found. Rept. 1909–10, p. 590.

Fruit Specks—Form more or less numerous, small, brown or black spots, starting at surface of fruit and slowly working inward; the true Fruit Spot often has a pinkish or purplish border in light-skinned varieties. Due to various fungi. Usually controlled by spraying as for Scab. Rept. 1909–10, p. 590.

Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered-cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the *cedar-apples*, which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state, as the leaves must be well coated continuously with spray from the time they begin to unfold, until the end of July. Repts. 1891, p. 161; 1909–10, p. 591.

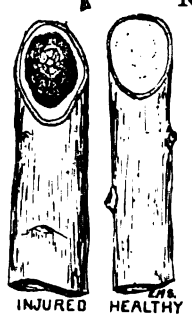
Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Spray the unfolding leaves before the blossoms open, again after the petals fall, and follow with a third spraying about four weeks later. For first treatment, use strong Bordeaux, for second and third, weak Bordeaux or lime-sulphur. Rept. 1909-10, p. 591.



Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, or often merging together. Spray with Bordeaux as for Scab, or with lime-sulphur 1½ to 50. Repts. 1909–10, p. 592; 1911, p. 367.

Blight—See Pear.

Spray Injury—Takes the form usually of burn on leaves and russeting on fruit. Is most likely to occur after second and later sprayings. Worst in wet seasons. Spraying in bright sunshine may cause some scorch of fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux only for *first* summer treatment or on varieties not especially subject to russeting. Rept. 1911, p. 360.



Winter Injury—Takes various forms from different conditions, such as imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened wood, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Repts. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool well aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

(1) Winter treatment (spraying dormant trees) is necessary only in the case of the presence of the San José scale, or leaf-blister mite, when commercial lime-sulphur, 1–9, or miscible oils, 1–15, may be used.

(2) As a rule, three summer treatments with a fungicide are necessary to control the fungous diseases, and the last two of these should contain an insecticide. These sprayings should be made as follows: 1st, just before the blossoms open, on the young unfolding leaves (April 27th to May 10th, according to the season and variety); 2nd, as soon as all the blossoms have fallen (May 10th to 30th); 3d, about one month later (usually June 10th to 25th).

(3) Where fungi are not prevalent, especially scab, the first summer treatment may be omitted. Occasionally, perhaps in

alternative years, where fungi are quite inconspicuous, the fungicide may be entirely omitted, and only the two sprayings with lead arsenate for insects given.

(4) For fungicides, we recommend Bordeaux mixture of the 4–4–50 strength for the first spraying, and of the 1–4–50 for the second and third sprayings; or commercial lime-sulphur, used at a strength of 1¼ to 1½ gallons per fifty gallons of water, for all three sprayings. The former has better fungicidal value, and the latter is less likely to produce spray injury, especially russeting of the fruit. Where fungi are prevalent, the former might be used, while with varieties russeting badly, as Baldwin, the latter is likely to prove more satisfactory; or use strong Bordeaux for first spraying and lime-sulphur for second and third.

(5) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(6) If canker worms, tent-caterpillar, bud-moth, or brown-tail moth are causing damage, add lead arsenate to the first summer treatment, and if aphids are present nicotine solution should also be included. Nicotine solution may be added to any of the subsequent treatments to destroy aphids, red bugs, tarnished plant bug, etc.

ASH.

Insects.

Oyster-Shell Scale—See Apple.

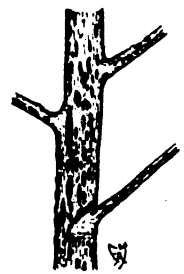
ASPARAGUS.

Insects.

Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate. Repts. 1902, p. 172; and 1903, p. 276.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi.



Rust—Produces (most conspicuous stages) small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with Resin Bordeaux partially controls the disease, but this is difficult and expensive. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertilization, with plenty of humus in the soil, are advocated as beneficial. Grow varieties most resistant to the disease and select seed for stock from resistant individuals if found. Repts. 1896, p. 281; 1904, p. 313.

ASTER.

Insects.

Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Practice hand-picking and cover choice plants with mosquito netting.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble whose cause is not definitely known. Buy best seed; transplant only healthy plants and have soil conditions good. Repts. 1903, p. 306; 1914, p. 413 (26).

BARLEY.

Insects.

Army Worm—See Grass.

Fungi.

Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats and Wheat. Rept. 1903, p. 306.

BEAN.

Insects.

Green Clover Worm—Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Rept. 1908, p. 828.

Weevils—Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.

Fungi.

Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are forming. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas usually having more of a translucent or watery character. Treat same as anthracnose. Repts. 1898, p. 262; 1903, p. 307.

Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. As the fungus usually appears first and most vigorously in low moist places, the land used should be high or well drained. Serious only in years unusually moist after the middle of July. Spray with Bordeaux, beginning about the middle of July, and repeat every 10–14 days until the first part of September. Rept. 1905, p. 278.

Rust—Produces small, round, reddish or black, dusty outbreaks, usually on the leaves. Plant varieties not likely to rust. Burn the old infected plants in the fall. Rept. 1903, p. 308.

BEET-CHARD.

Insects.

Leaf-Miner—A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lambs quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight—See Mangel. Rept. 1903, p. 309.

BEGONIA.

Eelworms.

Leaf-Blight Eelworm—Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns, etc. Spots vary in size and shape according to host and disposition of larger veins. Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

BIRCH.

Insects.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate in July. Rept. 1910, p. 701.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1st.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray about June 15th with lead arsenate. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stems of blackberries, raspberries and several other hosts. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Forms on leaves small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious but where necessary it probably can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.

Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts of the host, so that the disease appears year after year. Dig up and burn infected plants. Rept. 1903, p. 309.

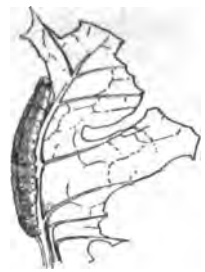
BOX.

Insects.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves. Fumigate the plants with hydrocyanic acid gas.

Oyster-Shell Scale—See Apple.

CABBAGE-CAULIFLOWER.



Insects.

Cabbage Worm—Green worms feed upon leaves all through season. Spray unheaded plants with lead arsenate. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in summer, and require same treatment. Bull. 190, p. 12, Rept. 1910, p. 706.

Cabbage Maggot—Infests stems of early-set plants near surface of ground checking growth and often killing them. Practice crop rotation. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Cabbage Aphis—Sucks sap from the leaves. Spray with nicotine solution or kerosene emulsion. Bull. 190, p. 14.

Fungi, etc.

Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; when possible avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should be treated in the fall with lime broadcast at the rate of 80 bushels per acre and worked in. Rept. 1903, p. 310.

Soft Rot—See Salsify. Report 1903, p. 311.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select, if feasible, only rust-resisting varieties. Spray in field with Bordeaux, adding 1½ lbs. soap to each 50 gallons (helps mixture to adhere to plants). Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse as dry as is consistent with good growth. One or two sprayings with Soap or Resin-Bordeaux, after transplanting in greenhouse, may be given if desired; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then as the stem gradually rots off at its base, the whole plant becomes affected and finally dies. Select cuttings only from perfectly healthy plants, and if necessary start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering, and see that roots are properly aerated. Repts. 1897, p. 175; 1903, p. 312.

CEDAR.

Insects.

Web-Worm—Small brown caterpillars feed upon the leaves which they web together. Spray with lead arsenate.

Fungi.

Cedar-Apple Rust—Appears in spring as conspicuous rounded galls with jelly-like horns bearing spores that carry the fungus to apple and related hosts. Cut off and burn all *cedar-apples*. See Apple Rust.

CELERY.

Insects.

Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy.

Fungi.

Leaf Blight and **Leaf Spot**—Are two diseases showing "rusty" spots on leaves and petioles; the latter trouble distinguished by the very minute black dots in the discolored spots (fig.), often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are often the means of introducing the trouble in the field. If necessary, continue the spraying after transplanting at intervals of about two weeks up to the middle of September. Before covering for bleaching, if leaf spot is abundant, dust with sulphur, and before final storage remove infected leaves and dust again. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil, avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.

CHERRY.

Insects.

Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray with lead arsenate or with hellebore.

Canker Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum.

Cherry Aphid—A brown aphid which sucks sap from under side of leaves causing them to curl. Spray with nicotine solution, soap and water, or kerosene emulsion.

Fungi.

Black Knot—Forms knot-like excrescences, usually several inches long, on twigs and branches. When planting, use only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is rarely advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of the mycelial threads in

the tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or atomic sulphur helps to keep new knots from fruiting, but is entirely secondary in importance to the removal of the knots. Rept. 1911, p. 399.

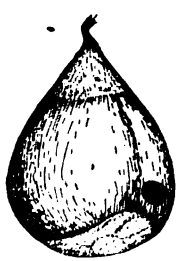
Brown Rot—See Plum. Rept. 1911, p. 402.

Leaf Spot—Shows as numerous, closely placed, purplish spots on leaves, which often have "Shotholes." Spraying, if begun on young leaves early in May, is effective but use the dilute Bordeaux, or better still, self-boiled lime-sulphur to avoid injury to the foliage. Give several sprayings at intervals of two weeks. This helps to keep down the brown rot also. Repts. 1895, p. 188; 1911, p. 401. Also known as Anthracnose.

Powdery Mildew—Develops a cobweb-like growth over the leaves; in fall forms numerous, minute, black fruiting-bodies, especially on under surfaces. Usually worst in young trees; controlled by spraying if necessary.

CHESTNUT-CHINQUAPIN.

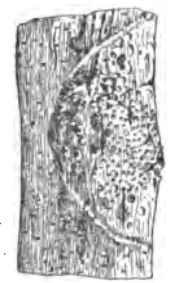
Insects.



Canker Worms—See Apple.

Nut Weevils—Long-nosed snout beetles lay eggs in developing fruit and the grubs infest the nuts. Destroy all infested nuts. Fumigate nuts with carbon disulphide as for beans.

Two-lined Chestnut Borer—Long, slender, flat-headed larvae make sinuous tunnels under bark of weakened chestnut and oak trees. Badly infested trees should be removed and burned, or the bark removed before the insects mature and spread to other trees.



Fungi.

Bark Disease (Blight)—Forms cankers in the bark that eventually girdle infected limb and cause death of parts above. Spreads over tree so that usually it dies within two to five years. Rarely shade trees can be saved by carefully cutting out and painting over the cankers. For forest trees it is best to let the disease take its course, and remove at least the larger trees within a year or two after their death to prevent deterioration of the wood. Rept. 1912, p. 359; Bull. 178.

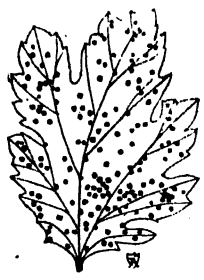
CHRYSANTHEMUM.

Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution.

Fungi.

Powdery Mildew—Develops a white mealy or cobweb coating on leaves. Use good judgment in airing and watering, and if necessary, spray from time to time with potassium sulphide or paint heating pipes with sulphur.



Rust—Appears as dusty reddish-brown outbreaks, about the size of a pin head, chiefly on under sides of leaves. Avoid worst rusting varieties. Start with cuttings free from rust. Destroy rusted leaves, especially on cuttings. Early sprayings with dilute copper sulphate, potassium sulphide, etc., may help to prevent the trouble from getting a start. Rept. 1903, p. 315.

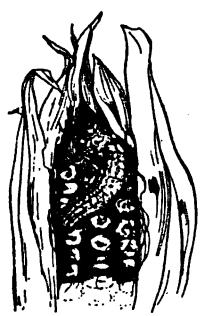
CINERARIA.

Insects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Use nicotine solution, or soap and water, as a spray or dip.

CORN.

Insects.



Cut Worms—See Tomato.

Army Worm—See Grass.

Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust with equal parts sulphur and powdered lead arsenate.

Fungi.

Leaf Blight—Kills parts of the leaves in August and September much like an early frost. Most injurious in wet late seasons. Plant early maturing varieties and stimulate growth by good fertilization and cultivation. Rept. 1903, p. 317.

Smut—Forms black dusty outbreaks that appear on various parts of the plant. It is especially injurious to certain varieties of sweet corn. Avoid the use of fresh manure on the land. Seed treatment is ineffective. The removal and destruction of spore masses is recommended by some writers.

CRANBERRY.

Insects.

Fireworm or **Black-headed Cranberry Worm**—Small, pale green, black-headed caterpillars web the leaves and new shoots together and feed inside the nest. Spray with lead arsenate to kill the caterpillars. Flood the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-headed caterpillars injure plants in same manner as the preceding. Spray with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berries. Flood the bog for about two weeks as soon as the fruit has been harvested. Destroy all infested berries.

CUCUMBERS.

Insects.

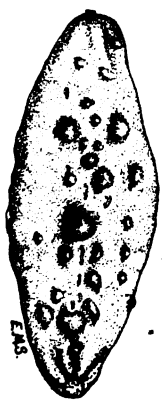
Striped Cucumber Beetle—Attacks young plants, eating the leaves. Larvae infest the main root or stem under ground, often killing the plant. Dust leaves with dry lead arsenate. Cover plants with screens. Rept. 1908, p. 807.

Melon Aphid—See Melon.

Fungi, etc.

Anthracnose—Produces prominent discolored spots, more or less merged, on leaves; occurs occasionally on fruit. Treatment is the same as for mildew. See Watermelon.

Downy Mildew—Forms discolored spots as in preceding, but beneath shows a minute thin growth of upright threads bearing dark colored spores. Repeated sprayings with Bordeaux about every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. The same fungus occurs on Melons. Rept. 1904, p. 329.



Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.

CURRANT.

Insects.

Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species of insects tunnel in the pith of the stems, causing the leaves to droop and wilt. Destroy infested canes during May.

Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1896, p. 238.

Currant Aphids—Yellowish-green aphids on under side of leaves causing them to curl. Underspray with nicotine solution or kerosene emulsion.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution. Bull. 143; Rept. 1903, p. 227.

Fungi.

Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until fruit begins to turn.

If necessary continue spraying after harvest. Rake up and burn leaves in fall.

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants. Alternate host is white pine. Report presence to the Experiment Station. Rept. 1911-12, p. 347. See Pine.

CYCLAMEN.

Insects.

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in nicotine solution, 1 part in 400 parts of water. Rept. 1914, p. 176.

DAHLIA.

Insects.

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer.

EGG-PLANT.

Insects.

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

Fungi.

Fruit Rots—Caused by several fungi, the Gray Mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster or spray with lead arsenate. Rept. 1906, p. 260.

Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1st, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnels in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

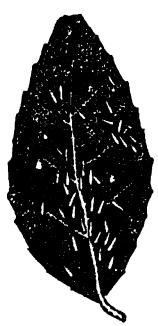
Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 235.

White Elm Scale—A whitish pear-shaped scale on twigs. Spray about June 10th with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form in cottony masses on the bark. Spray with kerosene emulsion.

Fungi.

Leaf Spot—Shows as black slightly elevated specks more or less thickly imbedded in the leaves and causing their premature fall. Not usually so injurious as to merit the expense of spraying with Bordeaux, which should start on the immature leaves. Rept. 1909-10, p. 717.



Insects.

EUONYMUS.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Bull. 151; Rept. 1905, p. 240.

Insects, etc.

FERN.

Woolly Bears—Several kinds of light brown hairy caterpillars devour the fronds in late summer. Spray with lead arsenate.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

Insects.

GERANIUM.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Fungi.

Gray Mold Rot—Produces dead spots on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plants; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

Insects.

GOOSEBERRY.

Currant Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.

Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties, also attacks currant, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—Not common as yet on cultivated varieties. See Currant.

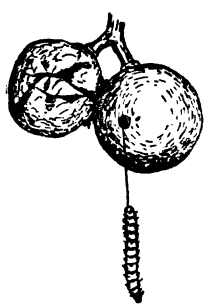
GRAPE.

Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.

Rose Chafer—Long-legged brown beetles appear about June 15th and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with lead arsenate just before blossoms open and if necessary again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.



Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leaf-Hopper—Small, yellow and red-marked leaf-hoppers sucking sap from under side of leaves. Spray under surface with nicotine solution.

Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.

Fungi.

Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; especially bad in rotting the berries, which finally become hard, shrunken and wrinkled, black mummies. This is one of the worst diseases of the grape and often difficult to control by spraying, which must be thorough, especially the first season. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10-14 days. Use Bordeaux up to the last of July and then change to Soda Bordeaux or Amm. Sol. Cop. Carbonate, though usually the 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops usually dense white patches of fruiting threads on under side of leaves and causes more or less discoloration on the upper; also occurs somewhat on stems and fruit. Treat as for black rot. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Rept. 1895, p. 185.

GRASS.

Insects.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1st to expose insects. Harrow very thoroughly before planting. Rept. 1912, p. 288; 1915, p. 179.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be confined to lawns and millet. The worm does not migrate in such great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.

Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Rept. 1907, p. 332.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1st, and burned or at least the bark removed. Spray healthy and slightly infested trees about June 1st, with strong

lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hickory Borer—Larvae tunnel deep into solid wood of trunk. Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Nut Weevils—Larvae infest the fruit or nuts. See Chestnut.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves to fall in midsummer. Galls contain large numbers of aphids. Spray with nicotine solution just as new growth starts in spring.

HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown outbreaks on both leaves and stems. After their death in fall, cut off the plants close to the ground, carefully gather up these and any rubbish that may contain spores, and destroy them. Spraying with Bordeaux is recommended by some as helpful in checking the rust; begin as plants push through ground. Rept. 1895, p. 188.

HOP.

Insects.

Hop-Vine Borer—Larva tunnels in tip, checking growth, and later in the stem above and below the surface of the ground. Crush larvae in the tips, remove soil from the base, and after leaving the main roots exposed for a week, apply wood ashes or ammoniated phosphate and hill up. The plants will make new roots.

Hop-Vine Snout Moth—Green, white-striped larvae feed upon the leaves in June. Spray with lead arsenate while the larvae are small.

Hop-Merchants—Brown, spiny caterpillars of two species of tortoise-shell butterflies feed upon the leaves. Spray with lead arsenate.

Hop Aphid—Green aphids suck the sap from the under leaf surface. Spray with kerosene emulsion.

Fungi.

Powdery Mildew—Coats leaves and stems with whitish powdery growth, the mature fruiting bodies finally showing as loosely imbedded blackish specks. Found here so far only on ornamental varieties. Make several sprayings with commercial L. & S. Rept. 1911-12, p. 349.

HORSE CHESTNUT.

Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Rept. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf Spot—Forms extended reddish-brown areas on the leaves, frequently resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can no doubt be controlled by spraying with Bordeaux, if the first application is made on the unfolding leaves and is followed by one or two subsequently on the mature leaves.

HORSE RADISH.

Insects.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

IRIS.

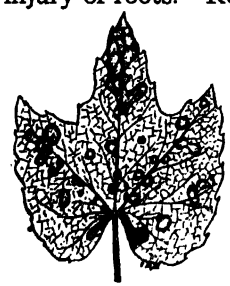
Insects.

Iris Root Borer—Larva tunnels in the rootstocks injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Rept. 1915, p. 189.

Fungi, etc.

Leaf Blight—Forms elliptical spots with purplish border; if abundant causes leaves to turn yellow and die prematurely; worst on German Iris. Keep foliage coated with Bordeaux or L. & S., beginning early; gather and burn infected rubbish in late fall.

Soft Rot—Attacks rootstocks destroying lower parts so that leaves turn yellow and die. Same bacterial disease described under Salisfy. Propagate only from healthy stock; plant in well drained soil; use only well rotted manure; prevent winter injury of roots. Rept. 1903, p. 327.



IVY, BOSTON.

Fungi.

Leaf Spot—Forms conspicuous brownish spots with purplish borders, which run together if abundant. Leaf stage of black rot of grape. Give several sprayings with commercial L. & S., beginning on unfolding leaves. Burn leaves in fall.

KALE.

Insects.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

LARCH.

Insects.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Woolly Aphid—White cottony tufts on the bark and at the leaf whorls. Spray with kerosene emulsion.

LETTUCE.

Insects.

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula C). Treat some days before using. Parsley is also subject to this disease in the greenhouse. Rept. 1908, p. 863.

Leaf Mold and **Mildew**—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth.

LILAC.

Insects.

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but hardly demands preventive treatment.

LILY.

Insects.

Aphid—Yellow plant lice with red markings, on under side of leaves. Spray with nicotine solution.

Stalk Borer—See Dahlia.

LINDEN.

Insects.

Canker Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

LOCUST.

Insects.

Locust Borer—Larvae *tunnel in solid wood of trunk.* Inject carbon disulphide into the burrow and close the entrance.

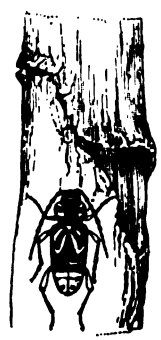
MANGEL.

Fungi.

Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; if necessary spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

MAPLE.



Insects.

Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1907, p. 336.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker Worms—See Apple.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves in midsummer; insects suck out the sap causing leaves to fall prematurely. Males and larvae enter crevices of bark of trunk and branches; larvae makes cases here and pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon after the young appear. Spray with miscible oils. Bull. 151; Repts. 1905, p. 237; 1913, p. 252.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 238.

Oyster-Shell Scale—See Apple.

Maple Aphids—Green Aphids are common on under surface of leaves of Norway and Sycamore Maples in June. Spray with nicotine solution or kerosene emulsion.

Fungi, etc.

Anthracnose—Causes more or less extended dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season and is difficult to foretell, but only occasionally serious. For this reason spraying of doubtful value in the long run, but when made should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—Forms slightly thickened black spots on the leaves, resembling finger prints. Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.

Leaf Scorch—Causes more or less extended and irregular dead areas to appear suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are probably best remedial measures. Rept. 1905, p. 267.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.

MELON (MUSK).

Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution. Rept. 1908, p. 813.

Striped Cucumber Beetle—See Cucumber.

Fungi.

Anthracnose—Appears occasionally. See Cucumber and Watermelon.

Downy Mildew—Forms angular eventually brown spots in the leaves, often stunting or killing vines; most prominent just before melons ripen, later ones often not maturing or worthless because lacking flavor. It is questionable whether this trouble can be controlled effectively and profitably by spraying during a very moist season. During dry or semi-moist seasons, however, results are satisfactory, so we recommend spraying as one of the regular operations of melon growing. It should be started soon after the vines begin to run, at least by the middle of July, and the vines should be kept covered with the Bordeaux to the end of the season. Rept. 1904, p. 329.

Leaf Mold—Develops dead spots on the leaves very similar to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves sucking the sap. Spray with nicotine solution.

OAK.

Insects.

Canker Worms—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

White Heart Rot—Forms on trunks shelf fungi, often somewhat hoof-shaped, eventually with dark, creased and cracked, upper surface and rusty-brown, porous, fruiting, lower surface. Gains entrance through wounded and dead branches; causes white rot of heart wood and slow death of sapwood and bark. Break off and burn fruiting bodies; if feasible cut out diseased bark and sapwood, and dig out dead heartwood and fill cavity with cement. Occurs in other deciduous trees.

OATS.

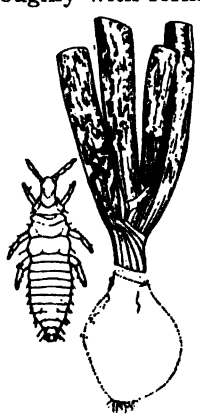
Insects.

Army Worm—See Grass.

Fungi.

Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown.

Smut—Destroys the grain, turning it into a black dusty mass of spores. Seed treatment will prevent this smut. Either soak the seed 8 to 10 minutes in water at 132–5° F., or sprinkle thoroughly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. Buy seed from smut-free fields.

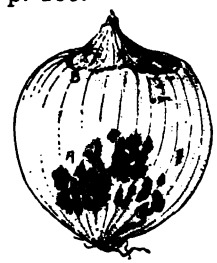


ONION.

Insects.

Thrips or **"White-Blast"**—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill over-wintering insects. Spray with nicotine solution or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.



Fungi, etc.

Anthracnose (Black Spot)—Produces black circular spots on the bulbs, usually on white varieties after storing in the barn. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Possibly air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.

Smut—Forms black dusty outbreaks on various parts of plants raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If, however, it is seeded, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 or 15 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Rept. 1889, p. 129; 1895, p. 176.

Brittle—Causes very young seedlings in the field to die suddenly; others show irregular curling and yellow spotting of leaves. The cause of this trouble is not definitely known. It usually starts in fields in spots which enlarge year after year until the land is worthless for onions. Experiments indicate the value of treating the land, when the seed is sown, with formalin or with sulphur and lime, as for smut. Rept. 1906, p. 332.

Stem Rot—Causes rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth of mold. This fungus in a moist season occurs on various parts of the plant in the field (possibly responsible for "blast" of seed onions), but does not usually appear as a serious trouble with the bulbs until some time after they have been placed in the barn. Treat same as for black spot. Late field spraying with Bordeaux shortly before pulling and again while lying in the field, combined with treatment by formalin fumes (See Fungicides) after storing, has given some indications of benefit. Fig. (B). Repts. 1903, p. 334; 1904, p. 321.

PAEONY.

Insects.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

PALMS.

Insects.

Scales—Several kinds of white and brown scales infest the species of palms grown in greenhouses. Apply nicotine solution or soap and water as a spray or as a dip.

Fungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus inconspicuous, may show as small black imbedded specks oozing pinkish masses of spores. Avoid infected stock or isolate it; pick off and burn worst infected leaves; keep leaves dry and house well ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

Insects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No remedy other than to destroy infested plants. Rept. 1913, p. 252.

Fungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip: See Salsify.

PEA.

Insects.

Green Pea Aphid—Attacks the plants early in June and sucks the sap from the leaves and stems, often causing great injury. Early peas may mature a crop before aphis injures them. Spray vines with nicotine solution and soap. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, emerging through round holes. Fumigate with carbon disulphide. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—The former shows as roundish spots on both pods and leaves; the latter, as a mealy or cobweb-

like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

PEACH.

Insects.

Peach Saw-Fly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Rept. 1909, p. 359.

Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.

Plum Curculio—See Plum.

San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.

Fungi, etc.

Brown Rot—Occurs on the young twigs, etc., but causes most serious injury to the fruit, rotting it about the time of its maturity. The rotten areas usually become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. Spraying these apparently pays in this state. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur 1-9. If more convenient this may be done in late fall and is claimed to be just as effective. Same treatment takes care of San José Scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs. Give winter treatment as for leaf

curl, and, if necessary, summer treatment as for scab and brown rot.

Scab—Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur, atomic sulphur or sulphur paste upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur with same treatment than on apple, which see. Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. See Apple. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit with yellowish curled leaves, and in time spindling sprout growths in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished, showing chiefly in the small backward fruit. Root out and burn all trees as soon as found; prevent winter injury; be careful in selecting stock for planting. Repts. 1893, p. 92; 1908, p. 872.

General Treatment for Peach Orchards.

(1) Spraying of peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall or early spring, will take care of all of these troubles at the same time. If the scale and the leaf curl are unusually prevalent, both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, it is as a rule desirable to give three sprayings, as follows: 1st, shortly after the blossoms have fallen (May 15th to May 25th); 2nd, about three or four weeks later (June 5th to June 15th); and 3d, about one month later (July 5th to July 15th). If only two sprayings can be given, omit the first if spraying only for rot, and the last if spraying only for scab.

(3) On the whole, self-boiled lime-sulphur of the 8-8-50 formula seems to be the safest and most reliable peach spray. Fair results have been obtained with some of the commercial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain

brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is recommended. Atomic sulphur and sulphur paste have given good results.

(4) As lead arsenate has done little to prevent curculio injury, and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger of sawfly injury, when it can be added in the second spraying the same as for apples.

PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.

Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Rept. 1901, p. 270.

San José Scale—See Peach.

Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime-sulphur in spring just before buds open. Spray infested trees with nicotine solution in July. Rept. 1903, p. 262.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds destroying them so that fruit does not set. Spray with nicotine solution just as buds open, and again after blossoms fall.

False Tarnished Plant Bug—Punctures developing fruit causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.

Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others; like Flemish Beauty, are very susceptible. Spray with Bordeaux on unfolding leaves before blossoms open, again after petals fall, and give the third spraying about two weeks later, using weak Bordeaux in last two treatments. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. This is a bacterial disease chiefly spread by bees during blossoming time, or by

sucking insects. Winter-prune all diseased branches, cutting off several inches below the diseased area. Cut out cankered areas and swab with disinfectant, paint exposed wood when dry. Several weeks after blossoming remove all young dead twigs. Use knife sterilized from time to time by wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1,000). This disease occurs also on apple and quince. Rept. 1894, p. 113.

Leaf Blight—See Quince.

PHLOX.

Insects.

Red Spider—Injures leaves causing them to turn yellow. Spray with kerosene emulsion, or with nicotine solution and soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves and young stems with grayish coating within which are finally imbedded numerous, small, blackish fruiting-bodies. Give several sprayings with commercial L. & S., starting before mildew gains much headway.

PINE.

Insects.

Sawflies—Larvae of several native and imported species feed upon the leaves. Spray with lead arsenate.

White Pine Weevil—Adult snout beetle lays eggs on leader in May and grubs feed and develop in it, causing it to wilt and die in midsummer. Leaders of ornamental trees may be protected by spraying them with lead arsenate or lime-sulphur. Jarring the adults into a net once a week during month of May, serves to greatly reduce the damage. Infested leaders should be cut and destroyed. Rept. 1911, p. 307.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; small trees sometimes killed. Spray with nicotine solution or kerosene emulsion about the second week in June. Bull. 151; Rept. 1905, p. 240.

Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Rept. 1911, p. 343.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips inward, often suddenly; so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem invading the base of the leaves which wither. Certain conifers more subject to attack then others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding

(see Fungicides, formalin C); spraying with Bordeaux effective in some cases. Repts. 1912, p. 348; 1915, p. 459.

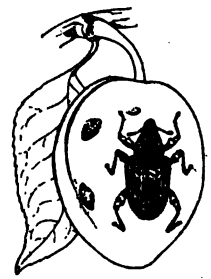
Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blister-like spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these (*q. v.*). A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed, and watch kept of the alternate hosts, if they occur in the neighborhood. Seed beds should never be made in the vicinity of the alternate hosts, as infection takes place easily in the young pine seedlings. In white pine plantations pull out all currants and gooseberries including those in the immediate neighborhood (500 feet). Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347.

PLUM.

Insects.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution or soap and water.

San José Scale—See Peach.



Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910, p. 609.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control by spraying, as spray does not readily adhere to the smooth fruit. First treatment with self-boiled lime sulphur, should be made on half grown fruit, second 14 days later, and last 10-14 days before picking. See Peach.

Crown Gall—Forms hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it except possibly on blackberries and imported roses. It also occurs on peach, apple, raspberry, and various ornamental plants.

POPLAR.

Insects.

Poplar Tent-maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907, p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping, and painting over exposed wood if surface is extended.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

POPPY.

Insects.

Apids—Black aphids suck sap from stems and leaves. Spray with nicotine solution.

POTATO.

Insects.

Flea Beetle—Small black jumping beetles eat holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate. Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines.

Potato Aphid—Green aphids appearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray with soap and nicotine solution.

Fungi, etc.

Black Leg—Causes a black rot of stem below ground; plants more or less stunted

with yellowish curled foliage; occasionally rots tubers. Usually only scattered plants in the field, apparently not spreading to the healthy. Soaking seed in formalin as for scab said to be helpful. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and often death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1st, and keep vines well covered to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to the tubers. Early varieties often escape blight by maturing before its appearance. Repts. 1904, p. 363; 1905, p. 304; 1909–10, p. 739; 1915, p. 470; 1916, p. 355.

Mosaic—Shows as a more or less conspicuous yellow-green mottling of the leaves. A physiological disease not well understood. New here but apparently not so injurious as in some other places. Do not save tubers for planting from hills showing this trouble.

Powdery Scab—Differs from common scab by smaller, more nearly circular and often powdery spots, with epidermis elevated at margins. Recently imported into Maine; rarely brought here on seed potatoes. Our experiments all indicate that this disease will not propagate in this state under ordinary conditions so it is no longer to be feared. Barely possible on cold wet soils in certain seasons infection might occur. If necessary, soak seed in formalin as for common scab, and roll in sulphur afterwards. Fig. (A). Rept. 1915, p. 463.

Scab—Produces the common scabby appearance on surface of tubers. Soak seed-tubers one and one-half hours in formalin (formula B). Formalin fumes (see Fungicides) are often used when large quantities are treated. Care in filling space sufficiently, however, is necessary to avoid injury by "pitting" from absorption of fumes. Avoid planting on infected land, by systematic rotation. The use of lime, wood ashes, and various barnyard manures will increase the amount of Scab. The same trouble occurs on beets and turnips. Fig. (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p. 166; 1896, p. 246; 1909–10, p. 744.

Tip Burn—Causes leaves to die at tip and margins and roll up; often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather. Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for Blight, as this often helps to increase yield by lengthening life of leaves.

PRIVET.

Insects.

Privet Leaf Folder—Larvae web together terminal leaves and feed inside. Clip off and destroy infested shoots. Spray with lead arsenate. Rept. 1913, p. 223.

Privet or **Lilac Borer**—See Lilac.

Fungi.

Anthracnose—Forms small cankers on stems causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; if bad spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

QUINCE.

Insects.

Round-Headed Borer—See Apple.

Quince Curculio—Grubs infest growing fruit and adults feed upon it causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate.

Aphid—See Apple.

Fungi, etc.

Black Rot—Rots the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for Leaf Blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Forms rounded, often confluent, reddish-brown spots with central black dots on leaves and fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with 1 or 2 additional treatments at intervals of about 2 weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders and filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Treat as for apple rust.

RADISH.

Insects.

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

RASPBERRY.

Insects.

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin Bordeaux. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate

ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Blackberry.

Wilt—Forms cankered areas on the canes causing the parts above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. The green berries often dry up without apparent cause, due to inoculation by insects. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Causes foliage to become more or less crinkled, and mottled with a sickly yellowish color. Plants gradually become worthless. Spraying does not seem to help this trouble, which apparently is of similar nature to peach yellows. Dig out plants with the yellows. Propagate only from perfectly healthy ones.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1910, p. 708.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

Rose Chafer—See Grape.

Leaf-Hopper—Sucks the sap from the under side of the leaves. Spray with nicotine solution.

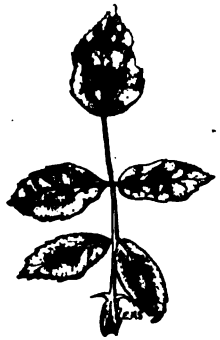
Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solotion.

Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.

Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially imported ones of Manetti stock. Inspectors now destroy all infected stock. There is some question how much infected plants eventually suffer. See Plum. Rept. 1911-12, p. 355.

Leaf Blotch—Forms large purple-black blotches on leaflets, which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if



there is no objection to the sediment on leaves. Rept. 1903, p. 355.

Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356.

RUTABAGA, See **TURNIP.**

RYE.

Insects.

Army Worm—See Grass.

Wheat Midge—See Wheat.

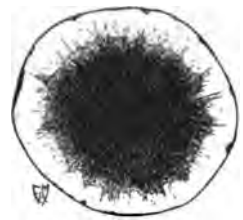
Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally abundant in cultivated fields. Keep these sclerotia out of cattle feed as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.

SALSIFY.

Fungi, etc.



Soft Rot—Forms a soft rot of the interior tissues of the roots running down from the crown and turning them a darker color. Usually occurs after storage. Same bacteria cause soft rots in a variety of plants. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

SNAPDRAGON.

Insects, etc.

Leaf Mites—Causes leaves to curl and plants do not blossom. Spray with nicotine solution. Rept. 1914, p. 176.

Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hot-beds as this far north the nematodes are killed in unprotected ground over winter. Attack roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in sum-

mer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often running together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves causing tissues above to become yellow spotted. Recently appearing in greenhouses and causing more or less injury according to prevalence. Treat as for anthracnose.

SNOWBALL.

Insects.

Aphids—Suck sap from the leaves causing them to curl. Use nicotine solution as a spray or dip.

SOY BEAN.

Fungi, etc.

Bacterial Leaf Spot—Forms small, dark, reddish-brown angular spots frequently merging into larger areas. Certain varieties appear more susceptible than others, Ito San being one of the worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

SPINACH.

Insects.

Spinach or **Beet Leaf-Miner**—See Beet.

SPIRAEA.

Insects.

Aphids—Suck sap from the new shoots. Use nicotine solution as a spray or dip.

SPRUCE.

Insects.

Spruce Gall Aphid—Forms galls at the base of the new growth on Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Rept. 1906, p. 302.

Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches causing much damage. Spray with lead arsenate. Rept. 1912, p. 291.

SQUASH-PUMPKIN.

Insects.

Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; Rept. 1908, p. 810.

Striped Cucumber Beetle—See Cucumber.

Squash Bug or "**Stink Bug**"—A brown bug three fourths of an inch in length sucks the sap from the under side of the leaves, causing them to wilt and die. Spray with kerosene emulsion to kill the young. The old bugs may be trapped by placing boards or shingles on the ground, which should be visited each morning and the bugs killed. Rept. 1908, p. 811.

Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Cut slits lengthwise in the stem and kill borers. Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Rept. 1908, p. 806.

Fungi.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross section of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clod up the water ducts. Fungi in

the ducts or insects at the roots may cause similar trouble. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.

STRAWBERRY.

Insects.

Strawberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistilate varieties in part. Spray with lead arsenate.

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution.

Strawberry Whitefly—Sucks sap from leaves. Underspray with nicotine solution.

Fungi.

Leaf Spot and **Blotch**—Cause conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter fungus. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. When necessary, this can probably be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

Fungi.

SWEET PEA.

Dampening Off—Rots off stem just below ground causing vines to turn yellow and finally die. Plant in well drained soil; place well rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

Insects.

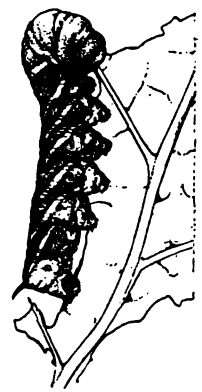
SWEET POTATO.

Tortoise-Shell Beetles—Feed upon leaves. Spray with lead arsenate.

Fungi.

SYCAMORE.

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half grown.



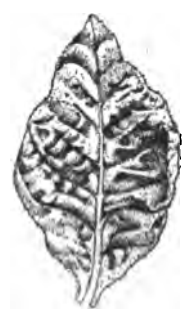
Insects.

TOBACCO.

Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Rept. 1906, p. 271.

Cut Worms—See Tomato.



Fungi, etc.

Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a physiological disease, due to injurious enzymes, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is

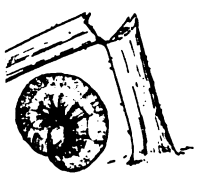
necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

Dampening Off—Due to various fungi which rot off the seedlings close to the ground, and cause them to fall over. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Occasionally it does more or less damage in fields, especially in alkaline or water soaked soils; a short rotation is advisable in such cases. Sterilize seed beds with steam or treat with formalin (formula C). Repts. 1906, p. 342; 1907, p. 363.

TOMATO.

Insects.



Cut Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut worms with small piece of board. Rept. 1906, p. 264; Bull. 190, p. 18.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

Stalk Borer—See Dahlia.

White-Fly—Sucks the sap from under side of leaves. Spray under side of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (1 oz. to 1,000 cubic ft.). Bull. 140; Rept. 1902, p. 148.

Fungi, etc.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10-14 days. This usually develops too late in the season here to cause serious damage.

Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying, apparently, is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown

growth which finally kills the tissue above. Spray with Bordeaux, picking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow and wither up slowly; fungus may finally show on dead stem and fruit as pinkish growth. Caused by fungus clogging ducts and cutting off water supply to leaves; in young stage presence shown by blackened bundles where stems are cut across. Change soil if appearing yearly; do not sow seeds from infected plants as they can carry the disease. Spraying of no value. Rept. 1903, p. 366.

TULIP TREE.

Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Bull. 151; Rept. 1905, p. 239; 1912, p. 294.

TURNIP-RUTABAGA.

Insects.

Cut Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking the sap. Underspray with soap and water or nicotine solution. Rept. 1916, p. 98.

Fungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 25.

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

VIOLET.

Insects, etc.

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

WALNUT.

Insects.

Walnut Caterpillar—Clusters of black caterpillars covered with whitish hairs strip the branches and finally the trees in August. Spray with lead arsenate. Clip off twigs when caterpillars are small, and kill by crushing. Rept. 1914, p. 191.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. Larvae tunnel in new shoots and infest the fruit of Persian and Japanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, webbing them together. Spray with lead arsenate. Rept. 1912, p. 253.

WATERMELON.

Fungi.

Anthracnose—Shows as more or less abundant, dark, sunken spots or areas on the fruit. Also infects leaves in spots. Usually appears here too near end of season to cause sufficient injury to warrant spraying; spray also fails to adhere well to the fruit. Rotation and removal of rotting melons from field may possibly be helpful restrictive measures.

WHEAT.

Insects.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant rather late—say about September 1st.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several closely related species on barley, rye, and wheat but quite distinct from the Black Stem Rust. Attempts are being made to secure resistant varieties to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head turning it into a dusty olive-black mass that is dissipated in time. Severe hot water treatment partially effective. See Oats.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Rept. 1909-10, p. 736.

WILLOW.

Insects.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and **Willow Curculio**—See Poplar.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closely related to those on poplar, *q. v.* The alternate host for one species is the larch and apparently there is another whose alternate host is not yet determined. Rept. 1915, p. 450.

MANUFACTURERS AND DEALERS IN SPRAY APPARATUS AND SUPPLIES.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

Aspinwall Manufacturing Co., Jackson, Mich. (Hand and power potato sprayers.)
Barnes Mfg. Co., Mansfield, Ohio. (Hand and power sprayers.)
Bateman Mfg. Co., Grenloch, N. J. (Iron Age sprayers for hand and power.)
Bean Spray Pump Co., Lansing, Mich.; San Jose, Calif. (Hand and power outfits.)
Brackett, Shaw & Lunt Co., Somersworth, N. H., 62 No. Washington St., Boston, Mass. (Hand and power outfits.)
Brown Co., E. C., Rochester, N. Y. (Compressed air, hand and power outfits.)
Church, Stephen B., Seymour, Conn., 64 Pearl St., Boston, Mass. (Power and hand sprayers.)
Cushman Sprayer Co., St. Joseph, Mo. (Power outfits.)
Dayton Manufacturing Co., 2240 East Third St., Dayton, Ohio. (Hand sprayers.)
Deming Co., Salem, Ohio. (Hand and power outfits.)
Douglas, W. & B., Middletown, Conn. (Hand and power pumps.)
Field Force Pump Co., Elmira, N. Y. (Hand and power pumps.)
Fitzhenry Guptill Co., 135 First St., East Cambridge, Mass. (Power sprayers.)
Friend Mfg. Co., Gasport, N. Y. (Power and hand pumps.)
Goulds Mfg., Co., 58 Pearl St., Boston, Mass.; 16 Murray St., New York. (Hand and power sprayers.)
Hardie Mfg. Co., Hudson, Mich.; Hagerstown, Md. (Hand and power pumps.)
Humphryes Mfg. Co., Mansfield, Ohio. (Hand and power pumps.)
Hurst Mfg. Co., H. L., Greenwich, Ohio.
Leggett & Brother, 301 Pearl St.,New York. (Hand and power dusting machines.)
Myers & Brother, F. E., Ashland, Ohio. (Hand and power pumps.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting machines.)
Rumsey Pump Co., Ltd., 49 Federal St., Boston, Mass. (Hand and power pumps.)
Spramotor Co., 107-109 Erie St., Buffalo, N. Y. (Hand and power outfits.)

MANUFACTURERS OF INSECTICIDES AND FUNGICIDES.

Blanchard Co., Jas. A., Hudson Terminal Bldg., 30 Church St., New York. (Insecticides and fungicides.)
Bowker Insecticide Co., 43 Chatham St., Boston, Mass., 1011 Fidelity Bldg., Baltimore, Md. (Insecticides and fungicides.)
Devoe & Raynolds Co., Inc., 101 Fulton St., New York. (Arsenical poisons.)
Frost Insecticide Co., 20 Mill St., Arlington, Mass. (Spray chemicals and apparatus.)
General Chemical Co., 25 Broad St., New York. (General insecticides and fungicides.)
Grasselli Chemical Co., 80 Maiden Lane, New York. (Insecticides and fungicides.)
Hemingway & Co., Inc., Bound Brook, N. J. (Arsenical poisons.)
Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)
Kentucky Tobacco Product Co., Louisville, Ky. (Nicotine solution.)

Lavanburg Co., Fred L., 100 William St., New York. (Arsenical poisons.)
Leggett & Brother, 301 Pearl St., New York. (Insecticides and fungicides.)
Mechling Bros. Mfg. Co., Line St., Camden, N. J. (Insecticides and fungicides.)
Merrimac Chemical Co., 33 Broad St., Boston, Mass. (Lead arsenate.)
National Color and Chemical Works, Selling Agents for Taylor Chemical Co., 59th St. & 11th Ave., New York. (Carbon disulphide.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting materials.)
Pratt Co., B. G., 50 Church St., New York. (Miscible oils.)
Riches, Piver & Co., 30 Church St., New York. (Arsenical poisons.)
Robertson Co., The J. T., 147 Richmond Ave., Syracuse, N. Y. (Miscible oils.)
Roessler & Hasslacher Chemical Co., 100 William St., New York. (Cyanide.)
Sherwin-Williams Co., 601 Canal Road, Cleveland, Ohio. (Lime-sulphur and arsenical poisons.)
Thum Co., O. & W., Grand Rapids, Mich., 15 India St., Boston, Mass. (Tanglefoot.)
Vreeland Chemical Mfg. Co., 50 Church St., New York. (Insecticides and fungicides.)

CONNECTICUT DEALERS IN SPRAYING SUPPLIES.

Dealers in spraying materials can usually be found in each town. Some of the larger firms are mentioned below.

Apothecaries Hall Co., 24 Benedict St., Waterbury. (Wholesale druggists.)
Barnes Bros., Yalesville. (Insecticides and fungicides.)
Cadwell & Jones, 1084 Main St., Hartford. (Pumps, insecticides and fungicides.)
Grasselli Chemical Co., River St., New Haven. (Insecticides and fungicides.)
Henry & Son, W. A., Blue Hills Farm, Wallingford. (Friend sprayers.)
Jewell, Harvey, Cromwell (Agent for Hardie hand and power sprayers.)
Leete Co., The Chas. S., 299 State St., New Haven. (Wholesale druggists.)
Lightbourn & Pond Co., 39 Broadway, New Haven. (Pumps, insecticides and fungicides.)
Platt Co., The Frank S., 845-855 Dixwell Ave., New Haven. (Pumps, insecticides and fungicides.)
Sisson Drug Co., 729 Main St., Hartford. (Spraying machines and insecticides.)
Whittlesey Co., The Chas. W., 259-271 State St., New Haven. (Wholesale druggists.)

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 200 DECEMBER, 1917

BEING THE

Twenty-Second Report

ON

Food Products

AND

Tenth Report on Drug Products

By JOHN PHILLIPS STREET

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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*Absent on leave. In service of the United States.

Twenty-Second Report on Food Products and Tenth Report on Drug Products, 1917.

By JOHN PHILLIPS STREET.*

As the prevalence of food adulteration decreases, the food work done by the Station on its own initiative has less to do with that feature. During recent years we have paid more attention to the nutritive value of foods, especially those which are either new to this state or the analyses of which have not yet appeared in our published reports. Eventually these reports will contain the analyses of practically all foods sold in Connecticut under distinctive brand names.

Aside from investigations of this kind, during the past year the Station has devoted considerable time to a study of bread. This has dealt with the influence of certain " yeast foods " or "bread improvers," as well as a study of variations in the weights of loaves of bread due to inequalities in the working of the molding machines and scaling operations at the bakeries, and also of variations due to the drying out of the loaves between the time of baking and their purchase by the consumer. The methods of fat determination in bread have also been reviewed, and losses in fat heretofore attributed to losses during the baking process have been shown to be due almost entirely to failure of the official method to extract the fat.

The laboratory also has studied in some detail the method of drying vegetables by means of a current of unheated air from an electric fan, and analyses of 18 dried vegetables are given in this report.

* The analytical work herein reported was done mainly by the writer's assistants, E. M. Bailey, C. B. Morison and C. E. Shepard. Especial credit is due to Mr. Morison for his painstaking work in connection with the difficult analysis of the drugs from physicians' stocks.

Unfortunately the laboratory's work on the composition of proprietary medicines has been interrupted this year. However, the chief chemist has prepared a book entitled "The Composition of Certain Patent and Proprietary Medicines," which has been published by the American Medical Association. This compilation gives the analyses of 2800 brands of these medicines, and should prove of use to physicians, pharmacists, inspection officials and to the general public.

In addition to 536 samples collected by our own agent, 678 samples collected by the Dairy and Food Commission were examined. These were chiefly milk, vinegar, Hamburg steak, sausage, physicians' drugs and toilet preparations. Of the 678 samples, 334 were found to be adulterated or below standard, 118 of these, however, being milks which were deficient only in solids-not-fat.

One hundred and forty samples sent by private individuals were tested, 44 of these samples being adulterated or below standard.

During the past year much of the time of the chief chemist has been occupied with work in connection with food and drug control in other allied organizations. He has served as a member of the Joint Committee on Food Definitions and Standards, Associate Editor of the Journal of the Association of Official Agricultural Chemists, expert on diabetic foods for the Council of the American Medical Association, Vice Chairman of the Section of Food and Drugs, Chairman of the Committee on Nostrums, and Director of the American Public Health Association, Secretary of the New England Association of Food Inspection Officials, and Chairman of the Committee of the American Association of Dairy, Food and Drug Officials on Co-operation with the Hoover Food Administration.

CANNED BEANS.

Sixty-two samples of canned beans were analyzed, including 5 of red kidney, 23 of lima and 34 of string and wax beans. The brand names of these samples are given below:

Red Kidney Beans.

7995. Sunbeam Pure Food Kidney Beans, Austin, Nichols and Co., Dist., New York.

8099. Oak Orchard Brand Red Kidney Beans, Batavia Canning Co., Batavia, New York.
8010. Burt Olney's Red Kidney Beans, The Burt Olney Canning Co., Oneida, N. Y.
8084. Oneida Chief Brand Red Kidney Beans, The Burt Olney Canning Co., Oneida, N. Y.
8105. Van Camp's Red Kidney Beans, The Van Camp Packing Co., Indianapolis, Ind.

Lima Beans.

8034. Medium Lima Beans, Acker, Merrall and Condit Co., New York.
8090. Valley Field Fresh Lima Beans, Austin, Nichols and Co., New York.
8022. Gold Rock Brand Small Tender Lima Beans, A. F. Beckman and Co., New York.
8049. Early Autumn Brand Lima Beans, Est. A. Brakeley, Bordentown, N. J.
7999. Luxury Lima Beans, Joseph Brakeley, Freehold, N. J.
8071. B. and M. Lima Beans (prepared by cooking dried lima beans), Burnham and Morrill, Portland, Me.
8042. Essie Brand Fancy Quality Lima Beans, James Butler, New York.
8104. Lima Beans, Curtice Brothers Co., Rochester, N. Y.
8080. Davisco Brand Lima Beans, F. H. Davis and Co., New London, Conn.
8095. Harrison Brand Lima Beans Standard Quality, Lewis De Groff and Son, New York.
8082. Aurora Brand Fancy Medium Green Lima Beans, Geneva Preserving Co., Geneva, N. Y.
8075. Gold Leaf Green Lima Beans, Granger and Co., Buffalo, N. Y.
8001. Royal Seal Brand Soaked Lima Beans, Granger and Co., Buffalo, N. Y.
8096. Green Mountain Brand Lima Beans (prepared from dried lima beans), Green Mountain Packing Co., Portland, Me.
8009. Webster's Best Brand Lima Beans, The Lord-Webster Co., Baltimore, Md.
8094. Country Club Brand Lima Beans (prepared from dried lima beans), quality unsurpassed, Portland Packing Co., Portland, Me.
8086. Hart Brand Little Quaker Lima Beans, W. R. Roach and Co., Hart, Mich.
8100. Monroe Brand Lima Beans (equal in quality to any so-called Extra Standards), Rochester Preserving Co., Rochester, N. Y.
8103. Portia Brand Lima Beans, Seeman Bros., New York.
8031. White Rose Brand Small Lima Beans, Seeman Bros., New York.
8077. The Famous Royal Scarlet Brand Small Lima Beans, R. C. Williams and Co., New York.
8011. Brownie Brand Lima Beans (prepared from dried lima beans), D. E. Winebrenner Co., Hanover, Pa.

8047. Empire Brand Green Lima Beans, First Quality, Winters and Prophet Canning Co., Mount Morris, N. Y.

String and Wax Beans.

8033. Noreca Brand Extra Standard Quality String Beans, Acker, Merrall and Condit Co., New York.

8091. Meadow Brook Brand Cut Golden Wax Beans, The Burt Olney Canning Co., Oneida, N. Y.

8069. Oneida Chief Brand Cut Golden Wax Beans, The Burt Olney Canning Co., Oneida, N. Y.

8068. Oneida Chief Brand Refugee Beans, The Burt Olney Canning Co., Oneida, N. Y.

8043. Essie Brand Fancy Quality Stringless Beans, James Butler, New York.

8093. Health Brand Cut Wax Beans, Lewis De Groff and Son, New York.

8079. Shield Brand String Beans, J. S. Farren and Co., Baltimore, Md.

8007. Eagle Brand Refugee Beans, Fort Stanwix Canning Co., Rome, N. Y.

8076. Waldorf Brand Tiny Golden Wax Beans, Fort Stanwix Canning Co., Rome, N. Y.

7996. Fredonia Beauty Brand Fancy Refugee Beans, Fredonia Preserving Co., Fredonia, N. Y.

8074. Royal Seal Brand Cut Golden Wax Beans, Granger and Co., Buffalo, N. Y.

7994. Royal Seal Brand Cut Golden Wax Beans, Granger and Co., Buffalo, N. Y.

8081. Royal Seal Brand Cut String Beans, Granger and Co., Buffalo, N. Y.

8087. Iona Brand String Beans, The Great Atlantic and Pacific Tea Co., Jersey City, N. J.

7997. Sultana Brand String Beans, The Great Atlantic and Pacific Tea Co., Jersey City, N. J.

8050. Green Mountain Brand Cranberry Stringless Beans, Green Mountain Packing Co., Portland, Me.

8097. Helmet Brand Golden Wax Beans, The E. S. Kibbe Co., Hartford, Conn.

8098. Our Choice Cut Golden Wax Beans, Medina Canning Co., Medina, N. Y.

8101. Forest King Brand Cut Refugee Beans, W. H. Osborn Co., Honeoye Falls, N. Y.

7993. Silver Key Brand Golden Wax Beans, Standard Quality, Oswego Preserving Co., Oswego, N. Y.

8085. Hart Brand Little Dot String Beans Extra Quality, W. R. Roach and Co., Hart, Mich.

8045. Bridal Brand Cut Wax Beans, Thos. Roberts and Co., Philadelphia, Pa.

8014. Golden Wedding Cut Refugee Beans, Fine Quality, Rochester Preserving Co., Rochester, N. Y.
8032. White Rose Brand String Beans, Seeman Bros., New York.
8102. White Rose Yellow Wax Beans, Seeman Bros., New York.
8000. Extra Standard Stringless Beans, B. F. Shriver Co., Union Mills, Md.
8023. Epicure Cut Stringless Beans, Extra Quality, John S. Sills and Sons, New York.
8089. Hermitage Brand Extra Stringless Refugee Beans, Our Fihest Quality, Stoddard, Gilbert and Co., New Haven.
8083. Hatchet Brand Extra Fine Refugee Beans, The Twitchell-Champlin Co., Portland, Me.
8106. Economy Brand Refugee String Beans, R. C. Williams and Co., New York.
8016. The Famous Royal Scarlet Brand Stringless Refugee Beans, R. C. Williams and Co., New York.
8070. Lusitania Brand String Beans, R. C. Williams and Co., New York.
8012. Conewago Brand Cut Refugee String Beans, D. E. Winebrenner Co., Hanover, Pa.
8046. Empire Brand Golden Wax Beans First Quality, Winters and Prophet Canning Co., Mount Morris, N. Y.

Tables I and II give the results of the physical examination of these samples, while Tables III and IV show the composition of both the drained beans and the separated liquor.

Physical Examination.

Proportion of Beans and Liquor. After weighing the sealed cans, they were opened and the liquor separated from the beans by draining through a colander.

The weight of drained beans in the red kidney beans ranged from 413 to 430 gms ; and that of the liquor from 178 to 205 gms. The liquor made up from 29.7 to 33.1 per cent. of the total weight of the can contents.

In the lima beans the variations in amounts of beans and liquor were much greater, the beans ranging from 297 to 413 gms.; and the liquor from 184 to 284 gms. The liquor made up from 31.3 to 48.9 per cent. of the total weight of the can contents, 9 of the 23 samples containing 40 per cent. or more of liquor.

The variations with the wax and string beans were likewise large. The weight of drained beans ranged from 240 to 376 gms., and that of the liquor from 203 to 323 gms. The liquor made up from 37.7 to 57.4 per cent. of the total net weight, 14 of the 34 samples containing 45 per cent. or more of liquor.

TABLE I.—RED KIDNEY AND LIMA BEANS.

Station No.	Brand.	Weight of Can and contents.	Weight of Beans and liquor.	Weight of Drained beans.	Weight of Liquor.	Weight of Per cent. liquor.	Weight of Contents. Claimed.	Weight of Contents. Found.	Cost per can.	Cost per lb. drained beans.	Size of beans.	Top of can above level of contents.
	Red Kidney Beans.	gms.	gms.	gms.	gms.		oz.	oz.	cts.	cts.		in.
7995	Sunbeam	728	619	414	205	33.1	20	21.9	10	10.9	...	1/4
*8099	Oak Orchard	699	591	413	178	30.1	19	20.9	10	10.9	...	3/8
8010	Bert Olney	718	615	427	188	30.6	20	21.7	10	10.7	...	9/16
8084	Oneida Chief	715	612	430	182	29.7	20	21.6	15	15.8	...	5/8
*8105	VanCamp	719	613	428	185	30.2	20	21.7	15	15.9	...	5/8
	Lima Beans.											
8034	Acker, Merrall & Condit	694	597	369	228	38.2	19	21.1	13	16.0	small	7/16
8090	Austin, Nichols & Co.	701	601	391	210	34.9	19	21.2	10	11.6	med.	7/16
*8022	Beckmann	697	577	345	232	40.2	19	20.4	15	19.7	"	1/4
8049	A. Brakeley	700	603	374	229	38.0	19	21.3	12	14.5	"	1/2
7999	J. Brakeley	697	598	413	185	31.3	19	21.1	12	13.2	"	7/16
8071	Burnham & Morrill	697	598	386	212	35.5	20	21.1	13	15.3	large	9/16
8042	Butler	688	588	338	250	42.5	19	20.8	15	20.2	small	9/16
8104	Curtice Bros.	679	578	363	215	37.3	20	20.3	12	15.0	med.	11/16
8080	Davis	694	595	384	211	35.5	20	21.0	15	17.7	small	7/16
*8095	De Groff	683	581	297	284	48.9	..	20.5	10	15.2	med.	1/4
8082	Geneva Pres. Co.	696	596	366	230	38.6	20	21.1	15	18.6	"	7/16
8075	Granger (Golf Leaf)	707	611	360	251	41.1	20	21.6	15	18.9	"	1/2
*8001	Granger (Royal Seal)	708	596	345	251	42.1	20	21.1	10	13.1	large	5/16
*8096	Green Mountain	711	607	399	208	34.3	20	21.4	13	14.7	"	1/4
8009	Webster's	689	598	355	243	40.6	20	21.1	12	15.4	med.	9/16
8094	Portland Pack. Co.	690	587	397	190	32.4	20	20.7	10	11.4	"	11/16
8086	Roach	715	615	369	246	40.0	20	21.7	17	20.9	small	3/8
8100	Rochester Pres. Co.	706	604	383	221	36.6	20	21.3	15	17.8	med.	1/2
8103	Seeman Bros. (Portia)	690	596	371	225	37.7	19	21.0	13	15.8	"	1/2
8031	Seeman Bros. (White Rose)	697	598	351	247	41.3	20	21.1	15	19.4	small	7/16
8077	Williams	688	592	391	201	34.0	20	20.9	15	17.4	"	9/16
8011	Winebrenner	686	590	347	243	41.1	20	20.8	10	13.1	large	1/2
*8047	Winters & Prophet	667	559	375	184	32.9	20	19.7	15	18.2	small	1/2

* In sanitary can.

From these data it appears that on the average the canned red kidney beans contain the least free liquor and the wax and string beans the most. The cut wax and string beans contained on the average 40.9 per cent. of free liquor, while the whole beans of this kind averaged 46.8 per cent.

Net Weight of Can Contents. All the samples but one bore a statement of net weight. Only one sample of lima and three of wax and string beans showed slight deficiencies of from 0.2 to 0.8 oz.

TABLE II.—WAX AND STRING BEANS.

Station No.	Brand.	Weight of					Weight of Contents.		Cost per can.	Cost per lb. drained beans.	Size of beans.	Whole or cut.	Top of can above level of contents.
		Can and contents.	Beans and liquor.	Drained beans.	Liquor.	Per cent. liquor.	Claimed.	Found.					
		gms.	gms.	gms.	gms.		oz.	oz.	cts.	cts.			in.
*8033	Noreca String	695	589	324	265	45.2	19	20.8	12	16.8	med.	whole	1/16
8091	Meadow Brook Wax	675	576	331	245	41.5	19	20.3	15	20.5	"	cut	7/16
8069	Oneida Chief Wax	683	585	344	241	41.2	18	20.6	15	19.8	"	"	3/8
8068	Oneida Chief Refugee	678	576	319	257	44.6	19	20.4	15	21.2	"	whole	5/8
*8043	Essie Stringless	686	581	337	244	42.0	19	20.5	17	22.9	small	"	1/8
*8093	Health Wax	672	565	331	234	41.4	19	19.9	15	20.5	large	cut	1/4
8079	Shield String	651	555	266	289	52.1	20	19.2	10	17.0	"	whole	9/16
*8007	Eagle Refugee	686	583	333	250	42.9	19	20.6	15	20.5	small	"	3/16
*8076	Waldorf Wax	684	582	280	302	51.9	19	20.5	15	24.3	"	"	3/16
*7996	Fredonia Refugee	680	573	346	227	39.6	20	20.2	15	19.7	"	"	1/4
*8074	Royal Seal Wax	669	568	344	224	39.4	19	20.0	10	13.2	large	cut	1/4
*7994	Royal Seal Wax	691	583	304	279	47.9	19	20.6	10	14.9	"	"	3/16
8081	Royal Seal String	684	577	345	232	40.2	19	20.3	12	15.7	med.	"	1/4
8087	Iona String	667	563	240	323	57.4	19	19.8	10	18.8	large	whole	9/16
*7997	Sultana String	686	577	356	221	38.3	19	20.4	8	10.2	"	cut	3/16
*8050	Green Mountain Stringless	691	594	357	237	40.0	19	21.0	13	16.5	"	"	1/16
*8097	Helmet Wax	699	593	311	282	47.6	19	21.0	15	21.8	small	whole	7/8
*8098	Medina Wax	678	572	341	231	40.4	19	20.3	10	13.3	med.	cut	1/4
*8101	Forest King Refugee	674	568	325	243	42.8	19	20.1	15	21.1	"	"	1/4
*7993	Silver Key Wax	645	539	336	203	37.7	19	18.7	13	17.6	large	whole	1/2
8085	Hart String	666	565	376	289	51.1	19	19.9	20	24.1	small	"	5/16
*8045	Bridal Wax	687	582	345	237	40.7	19	20.5	13	17.0	large	cut	3/16
8014	Golden Wedding Refugee	674	568	328	240	42.3	19	20.1	10	13.8	small	"	7/16
*8032	White Rose String	675	567	305	262	46.2	19	20.0	16	23.9	"	whole	1/4
*8102	White Rose Wax	684	580	334	246	42.4	19	20.4	15	20.3	"	"	1/4
8000	Shriver Stringless	663	561	304	257	45.8	20	19.8	10	15.0	mix.	"	1/2
8023	Epicure Stringless	683	575	351	224	39.0	20	20.3	15	19.4	large	cut	5/16
*8089	Hermitage Stringless	661	555	296	259	46.7	19	19.6	15	22.9	med.	whole	5/16
*8083	Hatchet Refugee	678	579	296	283	48.9	19	20.5	20	30.5	small	"	1/8
*8106	Economy String	668	567	274	293	51.7	19	20.0	12	19.8	large	"	3/16
*8016	Royal Scarlet Stringless	677	564	266	298	52.8	19	19.9	15	25.5	small	"	5/16
*8070	Lusitania String	659	562	287	275	48.9	19	19.8	12	19.0	large	"	5/16
*8012	Conewago String	687	581	360	221	38.0	20	20.5	10	12.6	"	cut	3/16
8046	Empire Wax	686	581	343	238	41.0	19	20.5	15	19.8	small	whole	3/8

* In sanitary can.

Fill of Cans. The distance between the level of the can contents and the top of the can ranged from 1/4 to 9/16 in. in the red kidney beans, from 1/4 to 11/16 in. in the lima beans, and from 1/16 to 5/8 in. in the wax and string beans. Nineteen of the 62 samples showed an air space of 1/2 in. or over.

Cost per Can. The cost of the red kidney beans ranged from 10 to 15 cents, that of the limas from 10 to 17 cents, and that of the wax and string beans from 8 to 20 cents per can.

TABLE III.—ANALYSES OF RED KIDNEY AND LIMA BEANS.

Station No.	Drained Beans.								Liquor.					
	Water.	Total ash.	Protein. (N×6.25.)	Fiber.	Nitrogen-free extract.	Ether extract.	Sodium chlorid.	Bean ash.	Water.	Solids.	Total ash.	Sodium chlorid.	Bean ash.	Acidity. cc ⅒ N NaOH per 100 cc.
Red Kidney.														
7995	70.14	1.42	7.27	1.24	19.38	0.55	0.51	0.91	88.06	11.94	1.78	0.99	0.79	24.0
8099	71.22	1.42	6.38	1.28	19.17	0.53	0.46	0.96	88.61	11.39	1.82	0.99	0.83	24.6
8010	71.16	1.37	7.51	1.28	18.18	0.50	0.44	0.93	86.84	13.16	1.52	0.71	0.81	28.8
8084	71.27	1.39	6.71	1.26	18.84	0.53	0.66	0.73	86.26	13.74	1.56	0.70	0.86	32.6
8105	70.77	1.37	7.52	1.34	18.49	0.51	0.46	0.91	87.69	12.31	1.74	1.01	0.73	22.2
Ave.	**70.91**	**1.40**	**7.08**	**1.28**	**18.81**	**0.52**	**0.51**	**0.89**	**87.49**	**12.51**	**1.68**	**0.88**	**0.80**	**26.4**
Lima.														
8034	77.07	1.35	5.34	1.41	14.45	0.38	0.69	0.66	93.63	6.37	1.79	1.10	0.69	16.6
8090	72.92	1.55	5.87	1.42	17.95	0.29	0.65	0.90	91.53	8.47	2.00	1.05	0.95	22.4
8022	74.84	1.79	5.75	1.46	15.87	0.29	1.17	0.62	92.86	7.14	2.30	1.70	0.60	15.4
8049	74.46	1.43	5.92	1.57	16.30	0.34	0.66	0.77	93.67	6.33	1.73	0.94	0.79	17.2
7999	74.25	1.49	6.25	1.46	16.25	0.30	0.78	0.71	92.82	7.18	1.86	1.01	0.85	23.4
8071	74.45	1.45	5.97	1.61	16.20	0.32	0.63	0.82	88.86	11.14	1.68	0.81	0.87	22.4
8042	77.23	1.45	5.60	1.70	13.64	0.38	0.70	0.75	94.52	5.48	1.72	1.07	0.65	13.4
8104	71.20	1.66	7.86	1.78	17.19	0.31	0.55	1.11	91.43	8.57	1.93	1.09	0.84	18.0
8080	75.63	1.52	5.91	1.46	15.04	0.44	0.77	0.75	92.88	7.12	1.74	1.01	0.73	15.8
8095	75.11	1.01	5.38	1.41	16.80	0.29	0.41	0.60	93.77	6.23	1.25	0.71	0.54	14.6
8082	74.34	1.55	5.88	1.71	16.16	0.36	0.73	0.82	94.11	5.89	1.92	1.09	0.83	19.2
8075	74.11	1.54	6.24	1.64	16.05	0.42	0.66	0.88	91.47	8.53	1.67	1.02	0.65	16.4
8001	72.18	1.43	5.94	1.70	18.32	0.43	0.72	0.71	88.94	11.06	1.74	0.93	0.79	20.6
8096	71.87	1.59	6.14	1.67	18.38	0.35	0.32	1.27	86.61	13.39	1.91	1.14	0.77	23.0
8009	73.30	1.73	6.12	1.50	17.03	0.32	1.07	0.66	92.12	7.88	2.20	1.41	0.79	18.0
8094	72.68	1.37	6.94	1.49	17.01	0.51	0.43	0.94	90.95	9.05	1.57	0.81	0.76	19.0
8086	76.92	1.60	5.61	1.63	13.79	0.45	0.76	0.84	94.43	5.57	1.82	1.21	0.61	10.8
8100	74.99	1.75	6.14	1.33	15.46	0.33	0.86	0.89	91.21	8.79	2.04	1.37	0.67	18.0
8103	72.25	1.53	5.84	1.62	18.36	0.40	0.66	0.87	92.27	7.73	1.89	1.11	0.78	19.4
8031	76.34	1.45	5.39	1.74	14.73	0.35	0.76	0.69	94.60	5.40	1.73	1.04	0.69	16.2
8077	75.61	1.43	5.68	1.45	15.41	0.42	0.64	0.79	91.84	8.16	1.69	0.92	0.77	19.2
8011	72.38	1.52	6.74	1.69	17.27	0.40	0.76	0.76	90.96	9.04	1.90	1.03	0.87	22.0
8047	75.06	1.11	5.28	1.54	16.59	0.42	0.61	0.50	92.95	7.05	1.61	1.02	0.59	14.0
Ave.	**74.31**	**1.49**	**6.99**	**1.57**	**16.27**	**0.37**	**0.69**	**0.80**	**92.11**	**7.89**	**1.81**	**1.07**	**0.74**	**18.0**

Cost per Pound of Drained Beans. The red kidney beans cost from 10.9 to 15.9 cents per pound of drained beans, the limas from 11.6 to 20.9 cents, and the wax and string beans from 10.2 to 30.5 cents. These wide variations in cost are influenced, of course, both by the cost per can and the proportion of drained beans present, and clearly indicate the possibilities of economy in a wise choice of brands. The apparently cheap brands are by no means always the most economical purchase, for very often their low cost is due to the relatively large amount of liquor sold with them.

TABLE IV.—ANALYSES OF WAX AND STRING BEANS.

Station No.	Drained Beans.								Liquor.					
	Water.	Total ash.	Protein. (Nx6.25).	Fiber.	Nitrogen-free extract.	Ether extract.	Sodium chlorid.	Bean ash.	Water.	Solids.	Total ash.	Sodium chlorid.	Bean ash.	Acidity. cc N/10 NaOH per 100 cc.
8033	92.27	1.76	1.29	0.90	3.68	0.10	1.37	0.39	95.52	4.48	1.72	1.47	0.25	12.0
8091	93.59	1.03	1.16	0.86	3.28	0.08	0.76	0.27	97.05	2.95	1.01	0.83	0.18	6.7
8069	93.88	1.02	1.28	0.81	2.93	0.08	0.53	0.49	97.15	2.85	0.93	0.69	0.24	7.8
8068	93.77	1.25	1.18	0.77	2.94	0.09	0.84	0.41	96.72	3.28	1.15	0.88	0.27	7.4
8043	93.23	1.18	1.50	0.87	3.13	0.09	0.77	0.41	96.35	3.65	1.10	0.83	0.27	11.2
8093	90.42	1.67	1.43	1.26	5.10	0.12	1.30	0.37	96.07	3.93	1.70	1.42	0.28	9.6
8079	91.77	1.47	1.26	0.94	4.41	0.15	1.09	0.38	96.10	3.90	1.35	1.11	0.24	13.2
8007	93.60	1.30	1.25	0.81	2.96	0.08	0.92	0.38	96.53	3.47	1.25	1.00	0.25	10.8
8076	93.51	1.50	1.21	0.80	2.90	0.08	1.12	0.38	96.61	3.39	1.45	1.20	0.25	7.6
7996	93.01	1.29	1.39	0.87	3.35	0.09	0.83	0.46	96.61	3.31	1.14	0.86	0.28	10.0
8074	91.92	0.85	1.05	0.92	5.18	0.08	0.61	0.24	95.74	4.26	0.82	0.55	0.27	8.4
7994	89.76	1.46	2.07	1.00	5.63	0.08	1.13	0.33	94.32	5.68	1.43	1.20	0.23	9.2
8081	93.59	1.41	1.30	0.94	2.66	0.10	0.82	0.59	96.75	3.25	1.11	0.87	0.24	12.0
8087	90.81	1.73	1.55	1.21	4.56	0.14	1.31	0.42	96.41	3.59	1.77	1.48	0.29	7.9
7997	93.43	1.23	1.26	0.86	3.14	0.08	0.85	0.38	96.74	3.26	1.15	0.90	0.25	8.8
8050	91.20	1.48	1.41	1.07	4.73	0.11	1.11	0.37	95.10	4.90	1.47	1.19	0.28	11.4
8097	93.55	1.36	1.51	0.82	2.67	0.09	0.94	0.42	96.74	3.26	1.25	1.01	0.24	7.4
8098	92.37	1.14	1.53	0.97	3.89	0.10	0.75	0.39	96.89	3.11	1.08	0.81	0.27	8.8
8101	94.09	0.74	1.16	0.88	3.05	0.08	0.38	0.36	97.36	2.64	0.65	0.41	0.24	8.8
7993	90.81	1.38	1.96	1.28	4.45	0.12	0.93	0.45	95.86	4.14	1.42	1.05	0.37	16.0
8085	92.87	1.17	1.70	0.91	3.24	0.11	0.71	0.46	96.54	3.46	1.07	0.76	0.31	7.9
8045	91.97	1.14	1.38	1.06	4.37	0.08	0.79	0.35	96.56	3.44	1.10	0.85	0.25	9.0
8014	93.46	1.17	1.16	1.01	3.11	0.09	0.79	0.38	96.91	3.09	1.05	0.83	0.32	9.6
8032	94.54	0.94	1.15	0.75	2.52	0.10	0.58	0.36	97.35	2.65	0.85	0.61	0.24	7.6
8102	93.73	1.15	1.30	0.84	2.90	0.08	0.75	0.40	96.82	3.18	1.07	0.81	0.26	7.3
8000	92.06	1.02	1.31	0.96	4.53	0.12	0.61	0.41	95.95	4.05	0.96	0.67	0.29	10.4
8023	93.64	1.58	1.02	0.81	2.87	0.08	1.25	0.33	96.23	3.77	1.56	1.34	0.22	15.6
8089	93.24	1.29	1.21	0.89	3.26	0.11	0.91	0.38	96.07	3.93	1.29	1.04	0.25	9.8
8083	94.16	1.27	1.17	0.78	2.53	0.09	0.84	0.43	96.93	3.07	1.18	0.99	0.19	8.0
8106	93.40	1.37	1.19	0.80	3.15	0.09	1.04	0.33	96.55	3.45	1.36	1.15	0.21	8.2
8016	94.05	1.10	1.29	0.80	2.67	0.09	0.75	0.35	97.15	2.85	1.02	0.82	0.20	8.8
8070	92.37	1.00	1.40	0.97	4.13	0.13	0.62	0.38	96.98	3.02	0.95	0.70	0.25	9.8
8012	93.76	1.27	1.18	0.88	2.81	0.10	0.95	0.32	96.71	3.29	1.25	1.03	0.22	10.4
8046	93.35	1.02	1.30	0.81	3.44	0.07	0.65	0.38	96.57	3.43	0.99	0.69	0.30	9.8
Ave.	**92.85**	**1.26**	**1.34**	**0.92**	**3.53**	**0.10**	**0.87**	**0.39**	**96.47**	**3.53**	**1.20**	**0.95**	**0.25**	**9.6**

CHEMICAL COMPOSITION.

Inasmuch as the liquor accompanying the beans is usually thrown away, the composition of the beans themselves is of chief interest.

The following tabulation shows the maximum, minimum and average amounts of food ingredients contained in the different classes of beans:

	Red Kidney.			*Lima.*			*Wax and String.*		
In drained beans:	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
Water	71.27	70.14	70.91	77.23	71.20	74.31	94.54	89.76	92.85
Protein	7.52	6.38	7.08	7.86	5.28	5.99	2.07	1.02	1.34
Fiber	1.34	1.24	1.28	1.78	1.33	1.57	1.28	0.75	0.92
Nitrogen-free extract	19.38	18.18	18.81	18.38	13.64	16.27	5.63	2.52	3.53
Ether extract	0.55	0.50	0.52	0.51	0.29	0.37	0.15	0.07	0.10
Ash, salt-free	0.96	0.73	0.89	1.27	0.50	0.80	0.59	0.24	0.39
Sodium chlorid	0.66	0.44	0.51	1.17	0.32	0.69	1.37	0.38	0.87
In liquor:									
Water	88.61	86.26	87.49	94.60	86.61	92.11	97.36	94.32	96.47
Ash, salt-free	0.86	0.73	0.80	0.93	0.54	0.74	0.37	0.18	0.25
Sodium chlorid	1.01	0.70	0.88	1.70	0.71	1.07	1.48	0.41	0.95

The brands of red kidney beans showed a remarkably uniform composition. On the average they contained about 29 per cent. of solids, one-fourth of which was protein, and the remaining three-fourths chiefly carbohydrates. The proportion of ether extract (fat) is almost negligible.

The lima beans on the average contained somewhat less solids than the red kidney beans, but the relative proportions of protein and carbohydrates were about the same. Five brands labeled "soaked beans" contained on the average about 2 per cent. more solids than the other brands, three-fourths of which was carbohydrates and one-fourth protein. Consequently these soaked beans contained somewhat more nutriment than the unsoaked varieties, but of course with less tenderness and flavor. On the other hand the soaked beans were considerably cheaper, costing on the average 11.2 cents per can and 13.5 cents per pound of drained beans, against 13.7 and 17.0 cents per pound, respectively, in the other brands.

The wax and string beans supply much less nutriment than either red kidney or lima beans, containing only about one-fourth as much solids, or 7.15 per cent. Furthermore, these beans generally contained more added salt than the other varieties, so so that the actual bean solids present averaged only 6.28 per cent.

The relative nutritive value of the three classes of beans is shown by the fact that on the average the drained solids in red kidney beans yield 108, lima beans 91 and wax and string beans 20 calories per 100 gms.

It is interesting to note that the liquor accompanying the

red kidney and the lima beans contained more nutriment than the drained wax and string beans themselves, and it is obvious that the housekeeper who discards the liquor of the two first-named varieties of beans throws away considerable valuable nutriment. The liquor of wax and string beans, on the other hand, is scarcely worth saving as it contains only 2.5 per cent. of salt-free solids.

Content of Tin.

Tin was determined in the solids and the liquor of all the samples, except in twelve liquors which were discarded by mistake. Table V shows the amounts found, expressed as mgms, per kilo or parts per million.

Table V.—Tin in Canned Beans (Mgms. per Kilo or Parts per Million.)

Number.	Tin.		Number.	Tin.		Number.	Tin.		Number.	Tin.	
	In solids.	In liquor.		In solids.	In liquor.		In solids.	In liquor.		In solids.	In liquor.
Red Kidney.			*Lima.*			*Wax or String.*			*Wax or String.*		
7995	117	32	8082	116	51	8069	338	62	8101	340	76
8099	204	26	8075	163	41	8068	368	77	7993	246	*
8010	164	35	8001	197	58	8043	382	104	8085	169	44
8084	108	40	8096	148	88	8093	106	32	8045	252	43
8105	210	26	8009	254	73	8079	577	69	8014	362	*
Lima.			8094	105	45	8007	348	*	8032	313	*
8034	157	49	8086	93	32	8076	410	98	8102	256	46
8090	121	73	8100	112	37	7996	430	*	8000	253	*
8022	224	116	8103	127	56	8074	199	52	8023	217	*
8049	123	54	8031	149	38	7994	196	*	8089	353	98
7999	118	70	8077	101	58	8081	381	91	8083	219	59
8071	147	102	8011	150	53	8087	283	54	8106	463	91
8042	163	34	8047	122	34	7997	425	*	8016	391	*
8104	129	35	*Wax or String.*			8050	311	75	8070	316	75
8080	121	48	8033	471	*	8097	630	121	8012	155	*
8095	116	63	8091	240	44	8098	272	54	8046	186	42

* Not determined.

The following is a summary of Table V:

	Red Kidney.			*Lima.*			*Wax and String.*		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
In solids, mgms..	210	108	161	254	93	142	630	106	319
In liquor, mgms..	40	26	32	116	32	56	121	32	69

The above figures are in entire harmony with those reported by other investigators. Canned beans as a rule show relatively large amounts of tin, wax and string beans generally containing much more than either red kidney of lima beans. The degree of toxicity of tin is still a somewhat open question, but at any rate its presence in any considerable quantity in a food is objectionable. The source of this tin is of course, the tin container, the amount contained in the food depending in part on the age of the food and the storage temperature. In the case of beans, and similar slightly acid foods, the tin present in the canned product has been shown to be due in part in some cases to the amino bodies present. It has been erroneously assumed that the tin in canned foods was in solution. Bigelow* (*Research Laboratories, Nat. Canners' Asso., Bull. 2, Aug. 1914), however, has shown that the tin is largely, sometimes chiefly, in some insoluble form. Moreover we are not justified in assuming that all of the tin found in the liquor even is in a soluble form, for it is quite probable that much of this is present as a finely divided "insoluble oxid, hydrated oxid, or basic salt of tin." Furthermore it is possible that much of the tin seemingly in solution is in colloidal form.

The smallness of our samples prevented further investigation along these very interesting lines. Nevertheless the fact remains that a number of these samples contained excessive amounts of tin. If it is possible for one packer of red kidney beans to keep the tin in his product down to 108 mgms., there seems to be no justifiable reason why another's brand should contain 210 mgms. in the drained beans. Similarly with lima beans, one brand showed only 93 mgms., and ten others less than 125 mgms., while two brands contained 224 and 254 mgms. In spite of the fact that wax and string beans as a rule carry more tin than other beans, we find one brand with only 106 mgms. in the drained solids; on the other hand twelve brands contained from 300 to 400 mgms.; six brands from 400 to 600 mgms.; and one brand 630 mgms. If these large amounts of tin are due to storage conditions and the age of the sample, it would seem that the consumer should be provided with some protection against such a situation.

Acidity of Liquor.

It has been suggested that the tin content is measured largely by the acidity of the liquor. Our results, however, indicate that

this is not the determining factor, as there is no close connection between the acidity of the bean liquor and the amount of tin present. The sample of red kidney beans showing the highest acidity contained the least tin, while the two brands of lima beans and the brand of string beans containing the most tin were all relatively low in acidity. The average acidity of the red kidney beans was 26.4, that of the lima beans 18.0, and that of the wax and string beans 9.6, while the last-named contained on the average twice as much tin in the solids as either the red kidney or lima beans.

EXPERIMENTS WITH BREAD.

These experiments have taken up the following points:

1. The advantages or disadvantages following the use of "yeast food" or "bread improvers," more particularly *Arkady Yeast Food.*
2. The losses of food nutriments in the baking of bread.
3. The determination of fat in bread.
4. A study of tolerances for the net weight of loaves of bread:
   a. Losses in weight due to drying out of the bread.
   b. Variations in weight of loaves due to bakery manufacturing conditions.

1. The Advantages or Disadvantages Following the Use of Yeast Foods or Bread Improvers.

The chief chemist of this Station has been charged by the Joint Committee on Food Definitions and Standards, with the collection of data relative to the preparation of a definition and the formulation of standards for bread. Incidental to this work it was deemed a matter of great importance to determine the role played in bread manufacture by the various "yeast foods" and "bread improvers," which are being brought more and more to the attention of bakers. These products are of two general classes: the malt preparations (extracts or flours), and the compounds which are alleged to supply to the yeast certain nutrients, which either stimulate the yeast or, by supplying particularly suitable food, increase its activity.

Five malt extracts, four malt flours and five samples of a yeast food were analyzed. These were as follows:

Malt Extracts.

9549. *Diamalt.*, The American Diamalt Co., Cincinnati, O.
9541. *Malt Extract*, Freihofer Baking Co., Philadelphia, Pa.
9546. *O. P. Malt*, Malt-Diastase Co., New York.
10004. *Roloco*, The Corby Co., Washington, D.C.
9453. *Malt Extract* (manufacturer unknown), used in test by S. S. Thompson Co., New Haven.

	9540	9541	9546	10004	9453
Alcohol by volume	3.20	3.20	5.20	*	*
Extract	75.41	75.72	74.42	76.92	76.92
Ash	1.47	1.63	1.85	0.87	1.83
Protein (N x 6.25)	5.63	7.63	6.75	3.44	6.44
Sugar solids+glycerin	68.31	66.46	65.82	72.61	68.65
Direct reducing sugars, as dextrose	41.70	41.62	40.04	*	*
Dextrin	21.05	22.04	20.78	*	*
Glycerin	0.12	0.12	0.12	*	*
Diastatic power (degrees (Lintner)	62.5°	105°	74°	*	*

* Not determined.

These samples are quite similar in composition, although No. **9541** shows a somewhat higher Lintner value than the other two brands tested.

Malt Flours.

9545. *Diasto Dry Malt*, Chas. E. Mechel, Milwaukee, Wis.
9543. *Maltora*, The Cabell Co., Baltimore, Md.
9544. *Malzo*, Advance Malt Products Co., Chicago, Ill.
9542. *Plymco*, Plymouth Milling Co., LeMars, Iowa.

	9545	9543	9544	9542
Water	6.02	7.91	9.94	11.15
Ash	2.21	2.34	1.63	0.36
Protein (N x 6.25)	15.38	14.81	14.06	8.94
Ether extract	2.51	2.62	2.12	0.55
Fiber	2.02	2.17	0.99	0.08
Nitrogen—free extract	71.86	70.15	71.26	78.92
Starch	44.38	46.01	48.60	72.17
Diastatic power	high	high	high	very low

The first three samples are very similar in composition. These three brands likewise all showed high diastatic power, No. **9544** being somewhat higher than the others. No. **9542** is a very

different preparation both as regards composition and diastatic activity, the latter being extremely low.

Yeast Food.

9424, 9514. *Arkady Yeast Food*, Ward Baking Co., New York.

	9424	9514
Water	5.99	5.58
Ash	49.45	48.47
Protein (N x 6.25)	4.75	4.38
Carbohydrates	36.34	38.08
Fat	0.38	0.38
Ammonia	3.09	3.11
Potassium bromate	0.298	*
Calcium oxid	9.64	*
Sulphuric anhydrid	13.31	*
Sodium chlorid	present	present

* Not determined.

Three other samples contained 5.41, 5.37 and 6.52 per cent. of moisture.

The formula of this preparation as given by the manufacturer is as follows:

Calcium sulphate	25.0
Ammonium chlorid	9.7
Potassium bromate	0.3
Sodium chlorid	25.0
Patent wheat flour	40.0

Our two analyses satisfy this formula in all respects.

Baking Tests.

A series of baking tests were conducted to study the effect of *Arkady Yeast Food*, our experiments at this time being limited to this particular preparation for the following reasons: First, it has been specifically attacked both as to the purposes of its use and because of alleged objectionable mineral ingredients it introduces into the bread; second, because it represents a distinct type of these foods (*i.e.* it is largely a mineral food); third, because no question has been raised as to objectionable ingredients being introduced by malt extracts or malt flours; and fourth, because of the time and labor consumed it was necessary to limit our first experiments to a single preparation.

The method of conducting the tests was as follows: Batches of dough ranging from 78 to 709 lbs. were prepared under strict

supervision, generally either under that of the writer or some other official authority, in one series the baker's regular formula being used; in the other Arkady was introduced, the amount of sugar, salt, yeast and generally flour being reduced. The weighing of all the ingredients was supervised, as well as that of the dough during its various stages, and that of the finished bread. Samples of the various ingredients and the baked breads were taken for analysis, either in triplicate or quadruplicate. Every precaution was taken to avoid mechanical loss during the tests, the loaves being molded by hand and a record being kept of the weight of dusting flour used. A complete baking record was kept for each test.

Disinterested parties supervised the weighings and various operations in all the tests but four (the latter being conducted independently by the baker although the writer analyzed the materials and the breads). Similarly the materials and the breads were always analyzed by three, and sometimes by four, laboratories, in every case, except the tests referred to above, at least two official laboratories taking part in the analysis. The following tabulation shows the extent of official supervision in each test.

Test.	*Bakery.*	*Supervisors.*
1	Ward Bakery, New York	3 Government chemists and writer.
2	" " "	" " " " "
3	" " "	Writer.
4–7	" " "	No official supervision.
8	Thompson Bakery, New Haven,	Writer and his assistant.
9	" " "	Writer's assistant.
10	Washington Barracks, D.C.	U. S. Army officers.
11–12	Taggart's Bakery, Indianapolis	State chemist.

In each of the twelve tests samples of the baking materials and the breads were sent to the writer for analysis. Likewise all the analytical data obtained by the various analysts has been submitted to the writer, and while these will of course be presented to the Standards Committee, only the results of our own laboratory will be discussed here.

Table VI shows the composition of the various baking materials and Tables VII to IX that of the breads, as determined in this laboratory. The analyses of the ingredients require no comment, except to call attention to the fact that actual analyses were made in all cases, except the oil and lard used. These were assumed

to be entirely fat, and even were this assumption not strictly correct, no error is introduced as in every comparative Non-Arkady and Arkady test equal amounts of these shortening materials were used.

TABLE VI. ANALYSES OF BAKING MATERIALS.

Material.	Baking test.	Water.	Ash.	Protein.	Carbohydrates.	Fat.
Flour, No. 1	1 & 2	12.49	0.50	10.72[1]	75.00	1.29
" No. 2	1 & 2	13.29	0.38	10.66[1]	74.56	1.11
" No. 3	3	12.89	0.46	11.00[1]	74.36	1.29
" "	4	13.20	0.40	10.66[1]	74.45	1.29
" "	5	13.29	0.40	10.94[1]	74.08	1.29
" "	6	13.40	0.45	10.89[1]	74.04	1.22
" "	7	13.03	0.49	11.00[1]	74.21	1.27
" No. 4	8	12.91	0.42	10.83[1]	74.74	1.10
" "	9	12.64	0.44	10.94[1]	74.86	1.12
" No. 5	10	12.82	0.53	11.69[1]	73.40	1.56
" No. 6	11	13.12	0.39	10.09[1]	75.31	1.09
" "	12	13.15	0.37	10.37[1]	74.98	1.13
Skim milk, condensed	1 & 2	30.97	1.97	8.29[2]	54.70	4.07
" " "	3–7	35.23	2.03	8.60[2]	49.79	4.35
" " "	11	32.14	2.03	8.93[2]	53.20	3.70
" " "	12	29.79	2.14	9.12[2]	54.82	4.13
Skim milk	8 & 9	91.68	0.69	.2.81[2]	4.40	0.42
Yeast, Corby's	1–7	73.81	2.42	14.88[3]	8.60	0.29
" "	10	72.50	2.54	15.62[3]	9.03	0.31
" "	11	70.93	2.41	14.75[3]	11.44	0.47
" "	12	75.70	2.41	14.56[3]	6.87	0.46
Arkady Yeast Food	1 & 2	5.99	49.45	4.75[4]	36.34	0.38
" " "	3–7	5.41	...	...	...	..
" " "	8 & 9	5.37	...	...	...	...
" " "	10	5.58	48.47	4.38[5]	38.08	0.38
" " "	11 & 12	6.52	...	...	...	0.41
Roloco, Corby's	11 & 12	23.08	0.87	3.44[3]	72.61	0.00
Malt extract	6	23.08	1.83	6.44[3]	68.52	0.13
Sugar	all	0.03	...	...	...	...
Salt	all	0.11	99.89	...	...	...
Cotton seed oil (assumed)	...	...	...	...	...	100.00
Lard (assumed)	8 & 9	...	...	...	...	100.00

[1] N x 5.7.
[2] N x 6.38.
[3] N x 6.25.
[4] N x 6.25 (plus 3.09% ammonia as chlorid.
[5] N x 6.25 (plus 3.11% ammonia as chlorid.)

TABLE VII.—ANALYSES OF BREADS (1 *hr. after baking*).

Bread.	Baking test.	Water.	Ash.	Protein (N×5.7).	Carbohydrates.	Fat.
Non-Arkady	1	37.11	1.36	7.58	51.77	2.18
"	2	36.35	1.45	7.81	52.34	2.05
"	3	36.18	1.41	7.28	52.85	2.28
"	4	36.51	1.36	7.58	52.25	2.30
"	5	36.23	1.46	7.57	52.61	2.13
"	6	37.67	1.47	7.49	51.20	2.17
"	7	35.38	1.43	7.88	53.32	1.99
"	8	31.84	1.74	8.61	55.98	1.83
"	9	34.59	1.52	8.01	53.90	1.98
"	10	38.32	1.53	7.86	51.36	0.93
"	11	39.48	1.24	6.90	50.63	1.75
"	12	36.09	1.26	7.42	53.42	1.81
Average (omitting tests 8 and 11)*		**36.44**	**1.43**	**7.65**	**52.50**	**1.98**
Arkady	1	36.60	1.49	7.87	52.03	2.01
"	2	35.27	1.53	7.92	53.13	2.15
"	3	35.95	1.45	7.69	52.57	2.34
"	4	35.33	1.40	7.84	53.08	2.35
"	5	35.59	1.47	7.85	52.89	2.20
"	6	37.16	1.47	7.64	51.47	2.26
"	7	36.06	1.49	7.75	52.66	2.04
"	8	34.61	1.73	8.19	53.70	1.77
"	9	35.74	1.54	7.88	53.04	1.80
"	10	37.85	1.55	8.10	51.47	1.03
"	11	37.72	1.13	7.08	52.27	1.80
"	12	34.91	1.24	7.53	54.49	1.83
Average (omitting tests 8 and 11)*		**36.05**	**1.46**	**7.81**	**52.68**	**2.00**

* See page 119 for reasons for ommission.

TABLE VIII.—LIME, SULPHATES AND AMMONIA IN BREADS.
(*In Original Substance*).

Bread.	Sulphuric anhydrid. Method 1.*	Sulphuric anhydrid. Method 2.**	Lime (CaO).	Ammonia. (NH_3).	Bread.	Sulphuric anhydrid. Method 1.*	Sulphuric anhydrid. Method 2.**	Lime (CaO).	Ammonia. (NH_3).
	%	%	%	%		%	%	%	%
Non-Arkady 1	.089	.015	.022	.0008	Arkady 1	.097	.060	.051	.0019
" 2	.056	.016	.015	.0007	" 2	.074	.055	.042	.0053
" 3	.043	.011	.020	.0008	" 3	.058	.055	.049	.0053
" 4	.040	.015	.023	.0008	" 4	.075	.059	.041	.0041
" 5	.056	.014	.017	.0027	" 5	.106	.052	.055	.0036
" 6	.027	.009	.017	.0011	" 6	.070	.045	.050	.0052
" 7	.050	.019	.018	.0017	" 7	.067	.059	.039	.0062
" 8	.063	.024	.031	.0019	" 8	.075	.077	.050	.0071
" 9	.077	.020	.023	.0009	" 9	.102	.071	.047	.0037
" 10	.085	..	.009	.0017	" 10	.114	..	.044	.0087
" 11	.068	.015	.021	.0017	" 11	.083	.056	.041	.0062
" 12	.050	.020	.024	.0019	" 12	.093	.061	.036	.0069
Average	**.059**	**.016**	**.020**	**.0014**	**Average**	**.085**	**.059**	**.046**	**.0051**

* Bread ashed, then treated with HCl.
** Bread treated with HCl. direct without ashing.

TABLE IX.—BROMIN IN BREADS.

(*Parts of Br. per* 100,000 *parts of air-dry bread.*)

Non-Arkady.		*Arkady.*	
1	0.25	1	0.50
2	0.25	2	0.50
3	0.25	3	0.50
4	0.25	4	0.50
5	0.425	5	0.75
6	0.425	6	0.75
7	0.25	7	0.50
8	0.30	8	0.625
9	0.25	9	0.50
10	0.25	10	0.50
11	0.30	11	0.625
12	0.30	12	0.688
Average	**0.29**	**Average**	**0.58**

On the following pages will be found the formulas used, the baking record, and the dry matter found in the materials and the breads of each test. Test 8, made at the Thompson Bakery, New Haven, has been omitted throughout, as a mixing of the loaves of the baked bread after sampling, in this test gave absurd and impossible results. Similarly the results of test 11 are also omitted as during the shipment of the breads from Indianapolis, the package became broken and possibly some bread was lost.

TABLE X.—BAKING FORMULAS.

Material.	Tests 1–2.		Tests 3–7.		Test 9.		Test 10.		Tests 11–12.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Flour	425*	419*	215*	212*	218*	218*	50*	49*	208*	208*
Water	240	240	120	120	93	94½	26	26	115	118
Sugar	11	9	5½	4½	5	4	¼	¼	...	...
Salt	7	6½	3½	3¼	4	3¾	⅛	⅛	2 8/100	2 66/100
Cotton seed oil	10	10	5	5	..	..	..	..	2 1/100	2 10/100
Lard	..	..	..	..	4	4	..	..	...	...
Condensed skimmed milk	11	11	5½	5½	..	..	..	..	10	10
Skimmed milk	..	..	..	..	32	32	..	..	...	...
Yeast	5	2½	2½	1¼	2	1	½	¼	3	1½
Arkady	..	2½	..	2 1/16	..	1	..	..	...	...
Roloco	..	..	..	..	..	..	...	..	8	7

* Dusting flour was added in each test as follows:

Non-Arkady: 1, 3.75 lbs., 2, 2.5 lbs., 3, 1.75 lbs., 4, 3.25 lbs., 5, 1.75 lbs., 6, 2.25 lbs., 7, 2.25 lbs., 9, 3 lbs., 10, 0.5 lb., 11, 2.25 lbs., 12, 2.81 lbs.

Arkady: 1, 5.5 lbs., 2, 4.25 lbs., 3, 2.75 lbs., 4, 2.25 lbs., 5, 2.5 lbs. 6, 2.5 lbs., 7. 2.75 lbs., 9, 3.5 lbs., 10, 0.5 lb., 11, 2.25 lbs., 12, 2.38 lbs.

Baking Formulas.

No attempt was made to dictate the baking formula used, this representing in all cases for the Non-Arkady bread the regular formula used at the bakery where the test was being conducted. Accordingly we have formulas representing the practice in a large wholesale bakery, in two smaller high-class bakeries and in a Government barracks bakery. In every case modifications of the regular formula were made necessary in the Arkady dough because of the use of that ingredient. The following decreased amounts were used in the Arkady doughs:

Tests 1-2. 6 lbs. flour, 2 lbs. sugar, 0.5 lb. salt, 2.5 lbs. yeast.
Tests 3-7. 3 lbs. flour, 1 lb. sugar, 0.25 lb. salt, 1.25 lb. yeast.
Test 9. 1 lb. sugar, 0.25 lb. salt, 1 lb. yeast.
Test 10. 1 lb. flour, 0.125 lb. sugar, 0.125 lb. salt, 0.25 lb. yeast.
Tests 11-12. 1 lb. Roloco, 0.25 lb. salt, 1.5 lbs. yeast.

Loss of Dry Matter in Baking Bread.

Table XI shows the amounts of dry matter introduced into the doughs by the ingredients used and the actual amounts recovered in the baked breads.

The results in Table XI may be summarized as follows:

Losses of Dry Matter.

	Pounds.		Per cent.		Less percentage loss shown by Arkady breads
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	
1	21.006	13.155	5.12	3.25	1.87
2	15.474	5.253	3.79	1.30	2.49
3	6.947	4.233	3.36	2.07	1.29
4	6.231	3.456	3.00	1.70	1.30
5	4.962	2.353	2.41	1.16	1.25
6	5.181	3.881	2.51	1.91	0.60
7	5.702	1.080	2.75	0.53	2.22
9	6.994	2.698	3.34	1.29	2.05
10	1.340	0.675	2.93	1.51	1.42
12	6.089	2.998	3.01	1.49	1.52
Average	.....	.....	**3.22**	**1.62**	**1.60**

In every test the Non-Arkady breads showed the greater loss in dry matter. This ranged from 1.340 to 21.006 lbs.; the Arkady breads showed losses of from 0.675 to 13.155 lbs.; in both cases the losses varying to a considerable extent with the amount of flour used. The percentage loss of dry matter in the Non-Arkady

Baking Record.

	Test 3.		Test 4.		Test 5.		Test 6.		Test 7.	
	Non-Ariady.	Ariady.	Non-Ariady.	Ariady.	Non-Ariady.	Ariady.	Non-Ariady.	Ariady.	Non-Ariady.	Ariady.
Temperature of flour	80.0	80.0	82.4	82.4	83.5	83.5	84.1	84.1	82.7	82.7
" " water	50.0	50.0	49.0	49.0	49.0	49.0	46.0	46.0	49.0	49.0
" " room	80.0	80.0	88.0	88.0	84.1	84.1	86.4	96. 4	80.2	80.2
Started mixing	8.10	8.48	7.50	8.30	7.57	8.30	8.04	8.44	7.44	8.25
Finished mixing	8.25	9.02	8.01	8.45	8.07	8.42	8.17	8.56	7.57	8.36
Temperature of dough when mixed	81.2	81.0	81.0	81.6	80.9	80.8	81.0	81.9	80.9	80.4
Weight of dough when mixed, lbs	355.5	352.0	354.75	350.5	354.0	350.25	354.5	349.75	355.5	351.75
First turn	10.55	11.32	10.31	11.15	10.37	11.12	10.47	11.26	10.27	11.06
Temperature at first turn	82.5	81.6	82.3	82.6	81.4	81.8	81.9	82.6	81.7	81.1
Second turn	12.25	1.02	11.46	12.30	11.52	12.27	12.02	12.41	11.42	12.21
Temperature at second turn	83.3	82.1	82.6	82.7	82.1	82.4	83.2	82.6	81.8	80.7
Dough ready for scaling	12.55	1.32	12.31	1.15	12.37	1.12	12.47	1.26	12.27	1.06
Weight of dough when scaled, lbs	352.5	350.25	353.25	348.24	351.25	349.0	..	..	353.25	350.0
Dough in proof box	1.35	2.10	1.15	2.00	1.27	2.05	1.15	1.57	1.03	1.48
Number of loaves	211	205	212	208	204	206	210	208	207	207
Dough going to oven	2.32	3.04	2.18	3.15	2.34	3.10	2.32	3.04	2.12	3.09
Bread baked	3.14	3.48	2.43	3.50	3.03	3.40	2.54	3.29	3.05	3.41
Weight of bread 1 hr. old	313.5	313.0	317.25	309.5	315.5	312.5	322.75	317.5	311.75	318.0

BAKING RECORD.

	Test 1.		Test 2.		Test 9.		Test 10.		Test 11.		Test 12.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Temperature of flour	61.7	61.7	66.5	66.5	76.8	76.8	74.0	74.0	73.7	73.7	75.0	75.0
" water	51.0	51.0	52.0	52.0	78.0	77.0	86.0	86.0	50.0	50.0	60.0	60.0
" room	79.0	81.0	80.0	80.0	80.0	80.0	80.0	80.0	78.0	78.0	76.0	76.0
Started mixing	10.55	12.24	9.36	10.35	7.39	8.10	8.07	8.10	7.49	8.48	6.46	7.37
Finished mixing	11.08	12.38	9.50	10.50	7.47	8.18	8.30	8.33	8.20	9.08	7.07	8.03
Temperature of dough when mixed	81.9	81.6	81.0	81.0	81.0	81.0	84.0	84.0	77.1	78.0	80.5	80.2
Weight of dough when mixed	704.19	695.94	704.24	699.25	357.5	358.0	78.75	77.5	340.5	344.25	343.75	344.75
First turn	1.35	2.54	12.20	1.20	10.32	11.03	10.59	11.01	11.00	11.38	9.42	10.35
Temperature at first turn	83.2	82.9	82.0	82.0	82.4	82.2	87.0	86.5	77.9	79.0	81.3	80.8
Second turn	2.35	3.54	1.20	2.20	11.32	12.03	11.59	12.01	12.30	1.08	10.42	11.35
Temperature at second turn	84.1	83.6	82.5	83.0	83.1	82.2	..	..	80.3	80.3	81.2	81.3
Third turn	3.20	4.39	2.05	3.05	..	..	..	..	..	..	..	..
Temperature at third turn	85.2	82.6	83.0	82.5	..	..	..	..	..	..	..	..
Dough ready for scaling	3.40	5.00	2.30	3.25	12.40	1.11	1.04	1.12	1.15	1.45	11.27	12.15
Weight of dough when scaled	698.	691.5	696.75	692.50	354.25	355.5	78.0	77.0	339.	343.	341.25	343.25
Dough in proof box	4.36	5.48	3.23	4.15	1.02	1.45	1.10	1.13	1.39	2.05	12.05	12.35
Number of loaves	410	413	410	415	312	315	35	35	..	..	..	..
Dough going to oven	5.30	6.45	4.21	5.15	2.05	3.05	2.25	2.33	2.28	3.05	12.54	1.36
Bread baked	6.00	7.15	4.52	5.46	2.25	3.35	3.55	4.03	3.02	3.45	1.29	2.10
Weight of bread 1 hr. old	618.75	618.50	616.75	614.75	309.25	321.25	72	71	303	306.75	307.5	305.5

Baking Record.

The baking record is given herewith in full, but the details will not be discussed here.

TABLE XI.—DRY MATTER IN MATERIALS AND BREAD.

	Test 1.		Test 2.		Test 3.		Test 4.		Test 5.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Flour	370.218	364.990	370.218	364.990	187.287	184.673	186.620	184.016	186.427	183.825
Sugar	10.997	8.997	10.997	8.997	5.499	4.499	5.499	4.499	5.499	4.499
Salt	6.992	6.493	6.992	6.493	3.496	3.247	3.496	3.247	3.496	3.247
Cotton seed oil	10.000	10.000	10.000	10.000	5.000	5.000	5.000	5.000	5.000	5.000
Condensed skim milk	7.593	7.593	7.593	7.593	3.562	3.562	3.562	3.562	3.562	3.562
Yeast	1.310	0.655	1.310	0.655	0.655	0.328	0.655	0.328	0.655	0.328
Arkady	....	1.998	....	1.998	...	1.005	...	1.005	...	1.005
Dusting flour	3.280	4.810	2.187	3.717	1.524	2.396	2.821	1.953	1.517	2.168
Total	410.138*	405.284*	408.035**	403.181**	207.023	204.710	207.653	203.610	206.156	203.634
Bread	389.132	392.129	392.561	397.928	200.076	200.477	201.422	200.154	201.194	201.281
Loss	21.006	13.155	15.474	5.253	6.947	4.233	6.231	3.456	4.962	2.353
Per cent. loss	5.12	3.25	3.79	1.30	3.36	2.07	3.00	1.70	2.41	1.16

* 0.252 lb. deducted for dough removed for fermentation test.

** 1.262 lb. deducted for dough removed for fermentation test.

TABLE XI.—DRY MATTER IN MATERIALS AND IN BREAD.—*Concluded.*

	Test 6.		Test 7.		Test 9.		Test 10.		Test 12.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Flour	186.190	183.592	186.986	184.376	190.445	190.445	43.590	42.718	180.648	180.648
Sugar	5.499	4.499	5.499	4.499	5.000	4.000	0.875	0.750	6.154†	5.384†
Salt	3.496	3.247	3.497	3.247	3.996	3.746	0.875	0.750	2.810	2.560
Cotton Seed Oil	5.000	5.000	5.000	5.000	4.000‡	4.000‡	..	..	2.810	2.810
Condensed Skim Milk	3.562	3.562	3.562	3.462	2.662	2.662	..	..	7.021	7.021
Yeast	0.655	0.328	0.655	0.328	0.550	0.275	0.13	80.069	0.729	0.365
Arkady	...	1.005	...	1.005	....	0.946	..	0.236	....	0.993
Dusting Flour	1.949	2.165	1.957	2.392	2.621	3.058	0.273	0.273	2.440	2.067
Total	206.351	203.398	207.155	204.409	209.274	209.132	45.751	44.796	202.612	201.848
Bread	201.170	199.517	201.453	203.329	202.280	206.435	44.411	44.121	196.523	198.850
Loss	5.181	3.881	5.702	1.080	6.994	2.698	1.340	0.675	6.089	2.998
Per cent loss	2.51	1.91	2.75	0.53	3.34	1.29	2.93	1.51	3.01	1.49

‡ Lard.
† Roloco.

breads ranged from 2.41 to 5.12 and in the Arkady breads from 0.53 to 3.25. Although there are considerable variations in the decreased losses of dry matter where Arkady was used, it is a striking fact that in every test the Arkady bread showed a lower loss, ranging from 0.60 to 2.49, average, 1.60 per cent.

In the first two tests the loaves of bread after baking were weighed on a Fairbanks scale. Although the accuracy of this scale and its weights were tested at the time of our test, it was realized later that an error might have been introduced, the scale not being sensitive to less than one-quarter of a pound. Any such error in weighing would probably be compensative and would have no serious effect on the results where losses as high as from 5 to 20 lbs. were shown. In the subsequent tests all the baked breads were weighed on a torsion balance sensitive to one gram. The uniformity of the results of all the tests indicates that the scale used in no way vitiated the conclusions from the first two tests.

The effect of the use of Arkady in conserving the dry matter of the dough is shown in the following summary where it is seen that not only does Arkady uniformly decrease the losses in dry matter attendant upon fermentation, but that an actual saving of original ingredients is also secured without in any way decreasing the food value of the bread (as will be shown on a later page).

SAVING IN DOUGH INGREDIENTS.

Test.	Arkady used.	Flour.	Sugar.	Salt.	Yeast.	Roloco.	Total.	Net saving in ingredients.	Saving in dry matter of dough.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	2.125	4.25	2.00	0.50	2.50	....	9.25	7.125	7.85
2	2.125	4.25	2.00	0.50	2.50	....	9.25	7.125	10.22
3	1.063	2.00	1.00	0.25	1.25	....	4.50	3.437	2.71
4	1.063	4.00	1.00	0.25	1.25	....	6.50	5.437	2.78
5	1.063	2.25	1.00	0.25	1.25	....	4.75	3.687	2.61
6	1.063	2.75	1.00	0.25	1.25	....	5.25	4.187	1.30
7	1.063	2.50	1.00	0.25	1.25	....	5.00	3.937	4.62
9	1.000	0.50	1.00	0.25	1.00	....	1.75	0.750	4.30
10	0.250	1.00	0.125	0.125	0.25	....	1.50	1.25	0.67
12	1.063	0.43	....	0.25	1.50	1.00	3.18	2.117	3.09
Totals	11.878	22.93	10.125	2.875	14.00	1.00	50.93	39.052	40.15

In other words in making 2,414 loaves of bread weighing 3,505 lbs.; the use of 11.878 lbs. of Arkady allowed the saving of 22.93 lbs. of flour, 10.125 lbs. of sugar, 2.875 lbs. of salt, 14.00 lbs. of yeast and 1.00 lb. of Roloco malt extract, or a total net saving in raw materials of 39.052 lbs. At the same time 40.15 lbs. of the dry matter of the dough was saved from unnecessary destruction by the yeast ferments. Calculating these results to the basis of 1,000 1.5 lb. loaves of bread, the saving in ingredients following the use of Arkady were as follows:

Saved.	*Used in Addition.*
9.50 lbs. flour	4.92 lbs. Arkady =
4.19 " sugar	1.23 " calcium sulphate
1.19 " salt	0.48 " ammonium chlorid
5.80 " yeast	0.01 " potassium bromate
0.41 " Roloco	1.23 " sodium chlorid (salt)
	1.97 " flour

In addition to the above, 16.63 lbs. of the dry matter of the dough was saved per thousand 1.5 lb. loaves. When one considers the millions of loaves of bread made annually such a conservation as is shown by these tests is well worthy of careful attention. Other questions, however, arise in this connection, viz.: is this conservation effected at a sacrifice of quality in the bread, and does the use of Arkady introduce into the bread any objectionable ingredients? These questions will now be discussed.

Composition of the Breads.

The criticism has been made that the use of Arkady enables the baker to use a lower grade of flour, and that in reality the main role played by its mineral salts, particularly the potassium bromate, is that of bleaching agents. The results of certain baking experiments submitted to us throw light on this point, and indicate quite clearly that the potassium bromate improves the baking qualities of flours in general. Three flours were tested, a high patent hard spring wheat flour, a low grade clear hard spring wheat flour, and a high patent soft winter wheat. The experiments showed that, while the bromate was effective for all the flours, the higher the grade of the flour used the greater was its effect. A loaf of finer texture and color followed the use of bromate, but such a result obviously is one of the main purposes of leavening bread. Ammonium chlorid gave similar results;

that is, the effect of that salt was less when low grade flours (containing a relatively high ash) were used than when the flour was a high patent, indicating that the ash ingredients of the lower grade flours provided sufficient mineral food for the yeast, and that the use of Arkady with a flour of this class was not advantageous.

The experiments quoted above also showed that the fineness of texture and the color of the crumb depended to a considerable extent on the amount of yeast used. While the bread made with Arcady was better in texture, color and general appearance than one made with the same amount of yeast but without Arkady, it was not of as good appearance or of as great volume as one where double the amount of yeast was used without Arkady. In other words the yeast itself appeared to have what might be considered a decided bleaching effect.

The quality of the breads obtained from the different doughs is clearly shown in Table VII. It has been claimed that Arkady increases the water-holding power of the dough and that a more moist bread results, in other words that its use permits the baker to market excess water as bread. Our tests show the contrary to be the case. Omitting test 8 for reasons already given, in only two of the ten tests did the Arkady bread contain more moisture than the other. The average moisture content of the Non-Arkady breads was slightly higher, 0.39 per cent., than in those where Arkady was used. Not only did the Arkady breads contain less water, but they also contained slightly more of each of the food nutrients. Moreover, unpublished experiments of Winslow and Falk of the Yale Medical School show that this slightly increased food value was not secured at the sacrifice of digestibility. Quoting these authorities: "If the results of this experiment, taken as a whole, indicate any effect of Arkady salts upon the digestibility of bread, the effect is a favorable rather than an inhibitory one. * * * We may safely conclude that the digestibility of Arkady bread is not effected by the yeast food used in its manufacture."

It is apparent, therefore, that the use of Arkady does not increase the moisture content of the bread, that it slightly increases its food value, and that it in no way decreases the bread's digestibility.

The Role of the Mineral Salts in Arkady.

There are, however, two other important points to be considered, namely, what is the fate of the mineral salts in the bread, and what effect, if any, do they have on its wholesomeness.

The Arkady process was developed from observations that breads made at different bakeries by the same process and using the same formulas and baking ingredients showed marked variations in flavor, texture and quality. Extensive investigations pointed to the different waters used as the source of the difference and that the varying amounts of inorganic salts contained in the different waters were the determining factor. The effect of the composition of the waters used has long been known in the brewing industry, the superiority of the waters of the Trent having given Burton ales a recognized high place among such products. Likewise it is an established fact that yeast needs certain mineral salts for its proper development and growth. While carbohydrates and nitrogenous matters are of course needed for the yeast's growth, the mineral salts are perhaps even more necessary. Experiments by Kohman and Hoffman* (**Jour. Ind. Eng. Chem.* 1916, 8, 781–789; *do.* 1917 9, 148–159), who developed the Arkady process, have shown that small amounts of calcium sulphate, ammonium chlorid and a trace of potassium bromate gave the most satisfactory results, and that a combination of these salts in the proper proportions worked better than any one of the salts by itself. The experiments of these authorities seem to establish that the calcium sulphate stimulates fermentation and increases the gas production, that the ammonium chlorid is used directly as a food by the yeast and that practically none is found as such in the baked bread, and that the potassium bromate has a marked effect in maturing the gluten, thereby conserving flour and sugar and effecting a considerable saving in the amount of yeast required. Experiments of Winslow and Falk show that the potassium bromate, in the dilutions in which this salt is introduced into bread by the Arkady process, has a pronounced effect in accelerating proteolytic ferments, an action similar to that observed in the dough.

Calcium Sulphate.

Lime and sulphates were determined in all the samples of bread. As was to be expected, in every instance, the Arkady breads con-

tained slightly more of these two mineral ingredients. The Non-Arkady bread contained on the average 0.020 and the Arkady 0.046 per cent. lime (CaO), with 0.059 and 0.085 per cent. of sulphate (as SO_3), respectively. (Direct treatment of the bread without ashing gave much lower percentages of sulphate in all the breads.) In other words, the Non-Arkady breads contained on the average 0.079 and the Arkady 0.135 per cent. of calcium sulphate. The amount of lime even in the Arkady breads is still only about one-tenth of the amount recognized as necessary in our daily diet. Many of our common foods are deficient in lime, and while the slightly increased content of lime in the Arkady breads probably has little practical significance, its effect, if any, would be beneficial rather than injurious. Forbes has told us (address Washington Academy of Sciences, July, 1916) of calcium that "Physiologically it is the great mineral stabilizer. Practically, it is much more frequently lacking in the food of men and animals than in any other mineral nutrient." The claim that Arkady is used in bread for the purpose of a make-weight is obviously false and absurd.

Ammonium Chlorid.

The claim is made by the manufacturer that the ammonium chlorid introduced by Arkady is completely utilized by the yeast and that, therefore, no increased amount should appear in the bread. Our determination of this salt by distillation with magnesia as shown in Table VIII, indicate that while most of the added ammonium chlorid does not appear as such in the finished bread, still the Arkady breads contain slightly more than where Arkady was not used, the average percentage being 0.0051 as compared with 0.0014. This small increase, however, is entirely without significance and can have no possible deleterious effect on the wholesomeness of the bread. In fact, many of our well-known foods contain ammonia in far greater amounts than does Arkady bread, for instance, Allenburys' Milk Food 0.0105, Honor Dry Milk 0.0178, Mammala 0.0182, Horlick's Malted Milk 0.0185, Nestle's Food 0.0061, Eskay's Food 0.0076, Imperial Granum 0.0071, Camembert cheese 0.1239, canned lobster 0.0874, ham 0.0365, buttermilk 0.0337, Swiss cheese 0.0090 and American cheese 0.0056 per cent. (Hoffman and Kohman's results).

Potassium Bromate.

The claim is made that the potassium bromate of Arkady is broken up by the fermentative processes of the yeast, and in the baking process and that whatever bromin is left in the bread is in the form of potassium bromid. Our experiments, not entirely completed, seem to sustain this claim. The amounts of bromin found in the breads were extremely small, the average content of the Non-Arkady bread being 0.29 and of the Arkady bread 0.58 part of bromin per 100,000 parts of air-dry bread. Calculated to the basis of the original breads, these values would be about 0.10 and 0.20 part per 100,000, respectively. Such extremely small amounts of bromin as bromid would be without physiological effect. Moreover the fact has been recently brought out that bromin is much more widely distributed in nature than has usually been supposed, and that many of our common foods contain it in appreciable amounts.

We have determined bromin in a number of foods, by the same method as was used for the breads, with the following results:

Parts of Bromin per 100,000 *parts of Air-dry Substance*

Table salt	6.27	Post Tavern Special	0.35
Fresh codfish	3.00	Gluten Bread	0.30
Salted codfish	1.50	Borden's Malted Milk	0.25
Celery	0.75	Brown Rice	0.25
Parsnips	0.75	Corn Meal	0.25
Haddock	0.50	Canned Lima Beans	0.25
Cabbage	0.50	Canned Kidney Beans	0.25
White Potatoes	0.40	Beets	0.25
Gluten Biscuit	0.35		

All of the above results as well as those secured in the breads, are doubtless slightly low owing to the difficulties of the method, but the results are at least comparative.

2. The Losses of Food Nutrients in the Baking of Bread.

In bread-making the action of the yeast causes a loss of carbohydrates, due to their fermentation and the formation of alcohol and carbonic acid gas, which are largely lost in the fermentation troughs or the oven.

The claim has been made that the use of Arkady not only requires less yeast but also that because of this smaller amount of yeast and because of the nutrient salts contained in Arkady less

TABLE XII: LOSSES OF FOOD NUTRIENTS.

Test.	Kind of Dough.	Total Weight of Bread.	Losses of				
			Water.	Ash.	Protein (N x 5.7).	Carbohydrates.	Fat.
1	Non-Arkady..	618.75	72.40	0.79	0.55	17.71	2.11
1	Arkady.....	618.50	72.87	0.47	+1.95	12.17	3.12
2	Non-Arkady..	616.75	75.62	0.24	+0.97	14.75	2.91
2	Arkady.....	614.75	78.81	0.25	+2.22	8.30	2.29
3	Non-Arkady..	313.50	38.09	0.24	1.85	4.19	0.88
3	Arkady.....	313.00	37.87	0.36	0.24	3.16	0.68
4	Non-Arkady..	317.25	36.56	0.22	0.04	5.42	0.75
4	Arkady.....	309.50	41.65	0.44	+0.73	3.24	0.73
5	Non-Arkady..	315.50	38.08	+0.07	0.65	3.28	1.31
5	Arkady.....	312.50	40.00	0.18	+0.38	1.64	1.13
6	Non-Arkady..	322.75	31.14	+0.10	0.34	4.49	0.89
6	Arkady.....	317.50	33.44	0.21	+0.24	3.23	0.67
7	Non-Arkady..	311.75	41.59	0.27	0.16	3.70	1.79
7	Arkady.....	318.00	36.03	0.23	+0.33	+0.08	1.48
9	Non-Arkady..	309.25	44.75	0.54	0.62	5.35	0.49
9	Arkady.....	321.25	37.80	0.51	0.02	1.33	0.84
10	Non-Arkady..	72.00	5.22	0.05	0.30	0.87	0.12
10	Arkady.....	71.00	5.64	0.04	0.06	0.53	0.04
11	Non-Arkady..	303.00	30.11	0.21	1.92	16.40	0.18
11	Arkady.....	306.75	35.80	0.73	0.90	9.18	+0.04
12	Non-Arkady..	307.50	38.84	0.07	0.67	5.30	0.05
12	Arkady.....	305.50	44.82	0.38	0.24	2.36	0.02

of the carbohydrates of the flour and the added sugar are destroyed during the fermentation process. The very complete analyses we have made of these breads prepared under carefully controlled conditions affords an opportunity to test the accuracy of these claims.

We determined water, ash, protein, fat and (by difference) carbohydrates in all the ingredients used in the doughs and in the breads themselves. Knowing the formulas used we can determine the exact amounts of each of these ingredients introduced into the dough and the amounts recovered in the bread.

Table XII gives the net losses for each type of bread sustained by the doughs during the fermentation and baking periods. While some of the losses are so small that they might be accounted for by experimental error, certain facts stand out very clearly. The study of the losses of dry matter reported on an earlier page

TABLE XIII: SUMMARY OF LOSSES OF FOOD NUTRIENTS.

Test.	Kind of Dough.	Average total weight of bread.	Losses in total bake.					Losses per 100 pounds of Bread.				
			Water.	Ash.	Protein (N x 5.7).	Carbohydrates.	Fat.	Water.	Ash.	Protein (N x 5.7).	Carbohydrates.	Fat.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1–2	Non-Arkady	617.75	74.01	0.52	+0.21	16.23	2.51	11.98	0.08	+0.03	2.63	0.41
1–2	Arkady....	616.63	75.84	0.36	+2.09	10.24	2.71	12.14	0.06	+0.34	1.66	0.44
3–9, 11, 12	Non-Arkady	312.94	37.40	0.17	0.78	6.02	0.79	11.96	0.05	0.25	1.92	0.25
3–9, 11, 12	Arkady....	313.00	38.43	0.38	+0.04	3.01	0.69	12.28	0.12	+0.01	0.96	0.22
10	Non-Arkady	72.00	5.22	0.05	0.30	0.87	0.12	7.25	0.07	0.42	1.21	0.17
10	Arkady....	71.00	5.64	0.04	0.06	0.53	0.04	7.94	0.06	0.08	0.75	0.06
Ave.	Non-Arkady	.....	.....	....	.....	.....	....	10.40	0.07	0.21	1.92	0.28
Ave.	Arkady....	.....	.....	....	.....	.....	....	10.79	0.08	+0.09	1.12	0.24

showed that the losses in the Arkady breads were uniformly less than in the Non-Arkady breads. That these losses, regardless of whether or not Arkady was used, fell chiefly on the carbohydrates Table XII shows very clearly. There were slight losses of ash and fat, but the main loss was in carbohydrates. In seven of the twenty-two tests, however, there was an actual gain in protein and in only two tests was there a decided loss. That all but one of these protein gains were shown by Arkady breads and that the two decided pretein losses were shown by Non-Arkady breads is at least suggestive. Although in each Non-Arkady dough there was twice as much yeast used as in the corresponding Arkady dough, it would appear that the smaller amount of yeast in the presence of the Arkady mineral salts was actually able to construct protein from the ammonia of the ammonium chlorid in an amount more than sufficient to compensate for any losses sustained by the protein of the flour during the manufacturing process.

Table XIII shows the losses on a more comparable basis. Our doughs, based on weight of ingredients, fall into three well-defined classes, yielding either 600, 300 or 72 lbs. of bread. Calculated to the basis of losses per 100 lbs. of bread we find both kinds of dough lost about the same amounts of ash and fat, and that the Arkady dough lost 0.39 lb. more water, with 0.30 lb. less loss of protein and 0.80 lb. less loss of carbohydrates. It would appear, therefore, that in these tests the use of Arkady requires not only

half the normal amount of yeast, but that by using this smaller amount of yeast less carbohydrates were destroyed, and that the presence of the Arkady salts, more particularly ammonium chlorid, stimulated yeast production with an actual increase of protein in appreciable amounts. Moreover, as has been shown on a earlier page, this saving of food ingredients was secured without any sacrifice in the quality or nutritive value of the bread.

3. The Determination of Fat in Bread.

It has been frequently suggested that the official method used for determining fat in cattle feeds by means of ether extraction does not remove all the fat from bread or other baked products. The following method has been suggested by the Bureau of Chemistry to obviate this difficulty:

Method: Treat 5 gms. of material in a loosely stoppered 200 cc Erlenmeyer flask with a mixture of 10 cc alcohol (95%), 2 cc concentrated ammonia and 3 cc of water, heating 2 minutes at the boiling point. Cool, add three successive portions of 25 cc of ethyl ether, mixing thoroughly, and tamping the material each time with a glass rod flattened at the end, pouring off the extracts into a 200 cc beaker. The combined ether extracts are evaporated to dryness on the steam bath. The crude fat is extracted by washing out with several portions of anhydrous ether or preferably petroleum ether, collected in a tared flask, evaporating and drying for periods of 30 minutes at 100° C. until constant weight is obtained.

Table XIV: Percentage Amount of Fat in Bread.

Official method.	Modified method.	Official method.	Modified method.		Official method.	Modified method.
0.51	2.01	0.56	2.30		0.73	1.75
0.70	2.18	0.68	2.35		0.64	1.80
0.68	2.15	0.62	2.13		0.70	1.81
0.63	2.05	0.61	2.20		0.70	1.83
0.65	2.28	0.17	0.93	**Ave.**	**0.59**	**1.95**
0.69	2.34	0.21	1.03			

In sixteen of the samples of bread we determined fat both by the official method and the one outlined above. The results show conclusively the inapplicability of the official method to such products as bread, and indicate that practically all of the published analyses of bread are inaccurate as regards the amount of fat present. The average result secured by the official method was 0.59 per cent. and that by the Bureau method 1.95 per cent.

SAMPLES IN CLOSET.

	A			B			C			D		
	First.	Last.	Loss.	First.	Last.	Loss.	First.	Last.	Loss.	First.	Last.	Loss.
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.
	19.19	19.05	0.14	15.52	15.49	0.03	26.17	25.71	0.46	16.90	16.75	0.15
	19.29	19.22	0.07	16.08	16.01	0.07	25.22	25.08	0.14	16.90	16.86	0.04
	19.01	18.94	0.07	15.65	15.52	0.11	24.34	24.00	0.34	16.23	16.12	0.11
	19.19	18.98	0.21	16.05	15.87	0.18	24.06	23.70	0.36	16.12	16.05	0.07
	19.26	19.22	0.04	17.11	17.04	0.07	25.26	25.01	0.25	16.16	16.19	+0.03
	19.61	19.44	0.17	16.72	16.51	0.21	24.73	24.41	0.32	16.61	16.51	0.10
	19.51	19.40	0.11	16.51	16.40	0.11	25.33	25.01	0.32	17.14	17.00	0.14
	18.84	18.77	0.07	15.77	15.63	0.14	24.13	24.00	0.13	16.58	16.51	0.07
	19.33	19.26	0.07	15.77	15.52	0.25	24.62	24.30	0.32	16.97	16.86	0.11
Ave.	**19.25**	**19.14**	**0.11**	**16.13**	**16.00**	**0.13**	**24.87**	**24.58**	**0.29**	**16.62**	**16.54**	**0.08**

SAMPLES ON SHELF.

	20.21	20.04	0.17	16.01	15.77	0.24	24.76	24.44	0.32	16.61	16.44	0.17
	19.33	19.19	0.14	16.54	16.33	0.21	24.51	24.23	0.28	17.28	17.07	0.21
	18.94	18.77	0.17	16.26	16.12	0.14	24.41	24.09	0.32	17.00	16.86	0.14
Ave.	**19.49**	**19.33**	**0.16**	**16.27**	**16.07**	**0.20**	**24.56**	**24.25**	**0.31**	**16.96**	**16.79**	**0.17**
Ave. of all	**19.31**			**16.17**			**24.79**			**16.71**		

4. EXPERIMENTS ON WEIGHTS AND LOSSES IN WEIGHT OF BREAD.

The bakeries of S. S. Thompson and the L. L. Gilbert Baking Corporation were visited on May 28 and samples of bread taken. In all cases the bread was wrapped and was slightly warm; with the Thompson samples the time since baking was 1½ hrs. with the Gilbert samples ¾ hr. The bread was weighed at the bakery, then taken to the laboratory, nine loaves of each series were piled three by three in a glass-front closet, each pile being kept separate from the others. The other three loaves of each sample were placed on an open shelf in the laboratory, each loaf being separated from its fellows. The bread was reweighed at 9 A M. on May 29, May 30, May 31 and June 1, or at intervals of 16, 40, 64 and 88 hrs. Inasmuch as the losses in weight were very trivial, the following tabulations give only the initial weight at the bakery and the final weight.

The breads were as follows:

A. S. S. Thompson Co. Health Bread. Claimed 18 oz., price 10 cts.

B. S. S. Thompson Co. Better-Yet Bread. Claimed 9 oz. or more, price 10 cts.

C. L. L. Gilbert Baking Corp. Holsum Bread. No weight claimed, price 15 cts.

D. L. L. Gilbert Baking Corp. Butter-Krust. Claimed 14 oz., price 10 cts.

The experiment has three aspects:

1. Losses in weight before consumption.
2. Variations in weight of the loaves.
3. Ability of baker to meet reasonably any claimed weight.

1. *Losses in Weight before Consumption.*

The losses in weight after 88 hours were as follows:

In Closet.

A. 0.04 to 0.21, ave. 0.11 oz.
B. 0.03 to 0.25, ave. 0.13 "
C. 0.13 to 0.46, ave. 0.29 "
D. +0.03 to 0.15, ave. 0.08 "

On Shelf.

A. 0.14 to 0.17, ave. 0.16 oz.
B. 0.14 to 0.24, ave. 0.20 "
C. 0.28 to 0.32, ave. 0.31 "
D. 0.14 to 0.21, ave. 0.17 "

Even after a period of nearly four days the losses in weight were in general trivial, the larger loaves, C, showing somewhat larger losses. Likewise the samples kept on the open shelves lost somewhat more than those kept in the closet. There were practically no losses in the wrapped loaves up to 40 hours. The first two days of the experiment were rainy or cloudy, the last two bright and clear.

The temperature in the room in which the loaves were kept showed the following variations from day to day:

55 to 62°, 56 to 61°, 59.5 to 66°, and 64 to 70° Fahr.

2. *Variations in Weight of the Loaves.*

A. From 18.84 to 20.21, average 19.31 oz.
7 varied less than 0.25 oz. from average
11 varied less than 0.50 oz. from average
1 varied more than 0.50 oz. from average

B. From 15.52 to 17.11, average 16.17 oz.
4 varied less than 0.25 oz. from average
9 varied less than 0.50 oz. from average
3 varied more than 0.50 oz. from average

C. From 24.06 to 26.17, average 24.79 oz.
3 varied less than 0.25 oz. from average
8 varied less than 0.50 oz. from average
4 varied more than 0.50 oz. from average

D. From 16.12 to 17.28, average 16.71 oz.
6 varied less than 0.25 oz. from average
9 varied less than 0.50 oz. from average
3 varied more than 0.50 oz. from average

Summary. 20 varied less than 0.25 oz. from average
37 varied less than 0.50 oz. from average
11 varied more than 0.50 oz. from average

Judging simply from the variations in weight above or below the average the above figures show that the bakers have difficulty in scaling their loaves to a uniform weight. This fact, however, does not prevent them from making a claim for weight which they can live up to if a little more tolerance is permitted for overweight than under-weight, as the following consideration will show:

3. *Ability of Baker to Meet any Claimed Weight.*

The present tolerance allowed for bread is 0.50 oz. on what was formerly the five-cent, but is now the ten-cent loaf.

We will disregard the weights actually claimed, as for C no claim was made, and in the other cases the claim is too much below the actual weights found. Each lot consisted of twelve loaves.

A. If 19 oz. had been claimed three loaves would have varied more than 0.50 oz. (+.051, +0.61 and +1.21).

B. If 16 oz. had been claimed four would have varied more than 0.50 oz. (+1.11, +0.72, +0.51 and +0.54).

C. If 24.5 oz. had been claimed four would have varied more than 0.50 oz. (+1.67, +0.72, +0.76 and +0.83).

D. If 16.5 oz. had been claimed two would have varied more than 0.50 oz. (+0.64 and +0.78).

From the above it appears that the baker in order to meet his claim with certainty must provide a considerable overrun. It does

not seem fair, therefore, to hold him as strictly accountable for excessive weight as for a deficiency. The recommendation is made, therefore, that the tolerance for bread both for the 10 cent and the 15 cent loaves should be not more than 0.50 oz. below or more than 1 oz. above the claimed weight. Applying these tolerances, of the 48 loaves only three would have exceeded the suggested claim by more than 1 oz. and none would have been deficient more than 0.50 oz.

Test of Variations in Weight of Loaves.

Certain bakers have protested against the tolerances in net weight of loaves of bread recognized by our regulations, claiming that unavoidably large variations necessarily followed the use of machines in moulding their bread. To test the accuracy of this claim we weighed a large number of loaves at two bakeries, 150 loaves in the one case, and 67 in the other. The bread was barely warm at the time of weighing, which was about three-quarters of an hour after removal from the ovens. It is unnecessary to give the detailed weighings, but the following is a summary of our results.

Bakery 1.

No. of loaves weighed	150
Lightest loaf	15.4 oz.
Heaviest loaf	17.1 oz.
Average loaf	16.3 oz.
1 loaf weighed	15.4 oz.
30 loaves weighed from	15.5—16.0 oz.
85 loaves weighed from	16.1—16.5 oz.
34 loaves weighed from	16.6—17.1 oz.

With a claim of 16 oz., only 1 loaf would have been more than 0.5 oz. below the claim, and 63 would have been more than 0.5 oz. above the claim; none would have been more than 1 oz. above the claim. The tolerances suggested on a previous page would have amply covered the unavoidable variations at this bakery.

Bakery 2.

No. of loaves weighed	67
Lightest loaf	15.7 oz.
Heaviest loaf	18.6 oz.
Average loaf	17.4 oz.
1 loaf weighed	15.7 oz.
4 loaves weighed from	16.1—16.5 oz.
9 loaves weighed from	16.6—17.0 oz.
29 loaves weighed from	17.1—17.5 oz.
24 loaves weighed from	17.6—18.6 oz.

With a claim of 16 oz., none would be more than 0.5 oz. below the claim, 62 would be more than 0.5 oz. above the claim, and 53 would be more than 1 oz. above the claim.

With a claim of 17 oz., 4 would be more than 0.5 oz. below the claim, 24 more than 0.5 oz. above the claim, and 13 more than 1 oz. above the claim.

It is apparent that the first bakery is much more accurate in its scaling than the second. No set of tolerances, which are justifiable, can be established to cover careless and wasteful methods of manufacture. The second bakery, with a claimed weight of 16 oz., apparently is giving the consumer much more bread than the latter has a right to expect from the weight guaranteed. The variations shown in this bakery are no argument against our tolerances. While overweight is no fraud against the consumer, the law requires a relatively accurate statement of net weight on the wrapper, and wide variations from this weight, even though in the consumer's favor, are not in harmony with the spirit of the net weight law. As before suggested, a tolerance of 0.50 oz. below and 1 oz. above the claimed weight seems to be ample for any baker who is willing to take ordinary precautions in scaling his loaves.

BREAKFAST FOODS.

Thirty samples were analyzed, the results of the analyses having been already published in Bulletin 197 of this Station. Below will be found a list of the brands, together with their claimed and actual net weight per package, and their cost.

Brand.	Cost per package, cts.	Net weight. Claimed. oz.	Found. oz.
Albers Wheat Flakes Mush	15	24	24.1
Bestovotes	15	..	19.7
Bran-eat Biscuits, Toasted	15	10	11.4
Bufceco Rolled Oats	10	20	21.1
Capitol Health Bran	15	28	24.1
Cerag	15	10	11.2
Cinnamon Rusks (Peterson)	18	14	12.9
Fruit Nut Cereal	15	11	11.7
Hecker's Cream Hominy	18	24	23.8
Hecker's Cream Oatmeal	10	20	19.9
Jersey Corn Flakes	10	9	10.8
Keen and Robinson's Granulated Scotch Oatmeal	40	32	32.6

Brand.	Cost per package, cts.	Net weight. Claimed. oz.	Found. oz.
Kellogg's Krumbles	10	..	11.5
Malabar Manoca (Bennett, Simpson and Co.).	20	16	16.3
McCann's Irish Oat Meal	35	32	32.9
Mother's Wheat Hearts	15	29	29.7
Pillsbury's Vitos	15	28	30.3
Post Tavern Porridge	18	28	31.9
Purina Sterilized Bran Zos	15	20	21.2
Purity Brand Rolled Oats	10	20	20.7
Quaker Brand Corn Puffs	9	6	7.3
Quaker (FS) Farina	10	14.5	14.9
Quaker Puffed Wheat	15	4	4.3
Ralston Wheat Food	22	24	24.6
Robinson's Patent Groats (in Powder)	50	16	16.3
Scott's Porage Oats	25	32	33.3
Sea Moss Farine	30	4	4.6
Sunbeam Pure Food Pearl Hominy	43	74	73.5
Washington Corn Crisps	10	10	13.7
Zim	15	9	9.2

The only two brands showing any material shortage in weight were *Capitol Health Bran* and *Peterson's Cinnamon Rusks*, which failed to satisfy their claims by 3.9 and 1.1 oz.; respectively.

BROSIA MEALS.

Brosia Meals are made by steam-cooking beans, pease or lentils, freeing them from the hulls and then grinding into meals. They are offered as substitutes for meat and from the standpoint of protein content compare favorably with that food.

Four brands of this product, sold by the Calumet Tea and Coffee Co., Chicago, were analyzed:

9464. *Lentil Brosia Meal*, Cost 25 cts. per lb.
9465. *Pease Brosia Meal*, Scotch, Cost 18 cts. per lb.
9466. *Pease Brosia Meal*, Cost 15 cts. per lb.
9467. *White Bean Brosia Meal*, Cost 18 cts. per lb.

	9464	9465	9466	9467
Water	7.86	8.16	7.16	8.91
Protein (N x 6.25)	29.75	27.00	29.13	24.56
Fat	1.32	1.84	2.63	1.78
Fiber	2.44	1.74	7.63	1.45
Ash	2.80	2.88	3.01	3.61
Nitrogen-free extract	55.83	58.38	50.44	59.69
Starch	41.23	41.85	20.08	35.66
Calories per 100 gms	354	358	342	353

The manufacturer tells us that "Diabetic patients will find lentil or pease or bean meal bread a happy change from gluten bread. Brosia breads contain but a small amount of the starch forbidden to such sufferers." It is true that these four meals contain much less starch than wheat flour and even many so-called gluten flours, but a satisfactory bread cannot be made from them alone, the manufacturer's formula suggesting a substitution of only one-fourth the usual quantity of flour. Breads made by such a formula would still be high in starch, much too high for any diabetic who did not have a very high starch tolerance.

BUTTER.

Of the 14 samples sent by the Dairy Commissioner, 11 were genuine, 2 were oleomargarine and 1 was renovated butter.

CHOCOLATE AND COCOA.

Five samples of these products were analyzed and will be reported in a forth coming Bulletin of this Station. The names of these brands are given below, together with their claimed and actual net weight, and their cost.

	Cost per package, cts.	Net Weight. Claimed.	Found.
Alkethrepta	25	8	8.5
Ghiradelli's Sweet Ground Chocolate and Cocoa	25	8	8.2
Hub Milk Chocolate Sweetened	48	16	16.2
Cocoatina, Anti-Dyspeptic Cocoa	45	8	8.1
Michaelis' Acorn-Cocoa	50	..	7.9

A sample of cocoa sent by the Dairy Commissioner contained no adulteration.

CONDENSED COFFEE.

The analysis of a sample of *Borden's Condensed Coffee Eagle Brand* will be reported shortly in a Bulletin. The net weight of the sample was 15.5 oz., and the cost 35 cents.

COFFEE SUBSTITUTES.

Six brands were tested as follows:

7977. *Drinket*, Kellogg Toasted Corn Flake Co., Battle Creek, Mich. Cost 22 cents for 4 oz.

8112. *Old Grist Mill*, a Substitute for Coffee, Potter and Wrightington, Boston, Mass. "A compound of whole wheat, vegetables, and a small amount of coffee for flavor." Cost 18 cents per 16.6 oz.

9576. *Jaffee*, Beech-Nut Packing Co., Canajoharie, N. Y.; "Made wholly of fruits and grains. Contains no coffee, caffeine or other stimulant." Cost 25 cents per 20.5 oz.

9574. *Postum Cereal*, Postum Cereal Co., Battle Creek, Mich. Cost 25 cents per 16.6 oz.

9463. *Calumet Cereal*, Calumet Tea and Coffee Co., Chicago, Ill.

9462. *Barley Coffee, Whole*, Calumet Tea and Coffee Co., Chicago, Ill.

	7977	8112	9576	9574	9463	9462
Water	8.04	9.64	9.91	9.11	9.11	6.20
Protein (N x 6.25)	5.69	15.13	11.00	12.38	13.06	10.81
Fat	0.03	3.87	1.66	3.30	4.44	2.73
Fiber	0.04	9.21	9.80	8.64	6.64	5.15
Ash	4.35	3.24	3.91	6.86	3.69	2.99
Nitrogen-free extract	81.85	58.91	63.72	59.71	63.06	72.12
Starch	*	30.38	16.40	19.20	37.97	42.80
Caffein	none	0.17	none	none	0.08	none

* Not determined.

These brands were free from coffee, except Nos. **8112** and **9463**, which contained 0.17 and 0.08 per cent. of caffeine respectively. These amounts, however, are practically negligible, being only one-seventh and one-fifteenth the quantities found in normal coffee.

CREAM.

A sample sent by the Dairy Commissioner contained 36 per cent. of butter fat.

Seven samples of cream were also studied as a basis for identifying homogenized creams, five being straight creams and the other two homogenized. Microscopic examination alone failed to differentiate these with accuracy. The variation in size of the fat globules in our experience did not appear to be as marked as the work of other investigators would indicate.

By allowing 10 cc of the cream, diluted to 100 cc with water, to stand 12 hours in a cylinder, the homogenized samples were

differentiated from the others very strikingly in this series of tests. How reliable the method is, however, can be judged only by further trials.

DIABETIC FOODS.

The following brands were analyzed:

9710. *Ayos, the Improved Soya Bean Flour*, Waukesha Health Products Co., Waukesha, Wis.

9483. *Lister's Diabetic Flour*, self Rising and Strictly Non-Carbohydrate, Lister Bros., New York.

9481. *Longuets de Lausanne*, Manuel Freres.

8768. *Genteel Flour* (manufacturer unknown).

9482. *Cocoa Factory Residue.*

9761. *Spinach Bread.*

	9710	9483	9481	8768	9482	9761
Water	8.75	11.62	10.78	11.41	8.46	.....
Ash	4.13	2.77	3.04	0.92	7.26	.....
Protein (N x 6.25)	41.44	67.38	14.19	17.13	14.44	.....
Fat	16.87	0.86	5.53	1.96	13.66	.....
Fiber	3.82	0.17	0.44	0.25	12.26	.....
Nitrogen-free extract	24.99	17.20	66.02	68.33	43.92	.....
Starch	0.56	none	49.16	60.52	3.57	44.41

Longuets de Lausanne contain altogether too much starch for a satisfactory diabetic food. *Genteel Flour* is a very inferior gluten flour. The other samples require no special comment.

Two other samples sent by a diabetic were also tested for starch. The first sample was rice that had been boiled three times, the supernatant water being discarded each time; the second was oatmeal porridge which had been washed well, squeezed twice and then boiled. The rice as received contained 83.78 per cent. water and 8.87 per cent. of starch; the oatmeal 82.83 and 3.40 per cent., respectively, indicating a starch reduction in the former of about 34 per cent., and in the latter of about 70 per cent.

FLAVORING EXTRACTS.

Nine samples were examined. These were all of the *Ariston Brand*, made by the Calumet Tea and Coffee Co., Chicago, Ill. The analyses indicate that the extracts are of excellent quality.

Flavor.	Spec. gr. @ 15.6° C.	Alcohol by vol.	Oil by vol.	Color.
Almond	0.8253	92.52	1.16	Normal
Celery	0.8226	92.35	0.73	Normal
Clove	0.8286	89.56	2.95	Normal
Lemon	0.8444	83.17	5.40	Normal
Orange	0.8424	87.45	4.96	Normal
Peppermint	0.8232	91.05	3.20	Normal
Wintergreen	0.8339	88.87	2.94	Normal

The sample of *ginger extract* had a spec. grav. of 0.8238, and contained 89.50 per cent. of alcohol by volume, 0.99 per cent. of solids, 0.93 per cent. of solids soluble in 95 per cent. alcohol, and 0.09 per cent. of solids soluble in cold water.

The sample of *vanilla extract* had a spec. grav. of 0.9750 and contained 39.75 per cent. of alcohol by volume, and 0.20 per cent. of vanillin; the lead number was 0.57, the color was normal and no coumarin was present.

PREPARED FLOURS.

Six samples of this class of food were examined, as follows:

9588. *D. and C. Self-Rising Flour*, The D. and C. Co., New York. "Soft winter wheat flour, grape cream of tartar, phosphate, soda and salt."

9577. *Grandma's Pancake Flour Mixture*, Hecker Cereal Co., New York. "Rice, wheat, corn and leavening materials."

9573. *Presto Self-Raising Flour*, The H-O Co., Buffalo, N. Y. "Leavening and seasoning agents are cream of tartar, bicarbonate of soda, phosphate and salt."

9589. *Reliable Self-Raising Prepared Flour*, Reliable Flour Co., Boston, Mass. "Wheat flour, grape cream of tartar, bicarbonate of soda and salt."

9572. *Swans Down Prepared Cake Flour*, Igleheart Bros., Evansville, Ind. "Not Self Rising."

9578. *Teco, Self-Rising Pancake Flour*, The Ekenberg Co., Cortland, N. Y. "A mixture of wheat and corn flour with malted buttermilk, salt, soda and acid phosphate."

	9588	9577	9573	9589	9572	9578
Water	12.60	11.56	12.50	12.02	12.66	11.37
Protein (N x 6.25)	9.06	8.50	8.13	9.00	8.50	10.38
Fat	0.91	0.91	0.90	0.68	0.82	1.73
Fiber	0.17	0.27	0.13	0.13	0.13	0.50

	9588	9577	9573	9589	9572	9578
Ash	3.77	4.56	3.56	3.53	0.49	7.21
Nitrogen-free extract	73.49	74.20	74.78	74.64	77.40	68.81
Sodium oxide	1.63	1.54	1.29	1.05	0.13	2.50
Potassium oxid	0.21	0.21	0.36	1.00	0.16	0.42
Phosphoric anhydrid	1.32	1.50	0.88	0.13	0.19	2.29
Sulphuric anhydrid	0.03	0.04	0.10	0.08	0.01	0.11
Chlorin	0.76	0.93	0.82	0.45	trace	0.68
Calcium oxid	trace	0.44	0.30	trace	trace	0.75
Tartrates	(?) none	present	(?) none	present	present	none
Weight claimed, oz.	18	18	20	24	36	16
Weight found, oz.	18.2	18.0	19.2	23.8	43.5	16.0
Cost per package, cts.	14	16	15	20	45	15
Cost per lb., cts.	12.3	14.2	12.5	13.5	16.6	15.0

The claims made for these flours seem to be substantiated by our analyses, except that we were unable to detect cream of tartar in Nos. **9588** and **9573.**

FRUIT JUICES.

Five brands of fruit juices were examined as follows:

9587. *Dole's Pure Hawaiian Pineapple Juice,* Hawaiian Pineapple Products Co., Honolulu, Haw. Cost 10 cents per 4.8 fl. oz.

9581. *Du Belle Grape Juice,* Du Belle Grape Juice Co., Rochester, N. Y. "About 2% granulated sugar." Cost 20 cents per 16 fl. oz.

9580. *Hay's Five Fruit,* H. H. Hay Sons, Portland Me. "Strawberries, raspberries, pineapples, oranges, lemons." "1/10 of 1 per cent. sodium benzoate, artificially colored." Cost 40 cents per 16.3 fl. oz.

5582. *Phez,* Pheasant Brand Loganberry Juice, with Sugar, Pheasant Fruit Juice Co., Salem, Ore.

9582. *Tim Pine,* J. Tim Co., New York. "Pineapple juice with sugar added." Cost 25 cents per 15.8 fl. oz.

	9587	9581	9580	5582	9582
Alcohol by volume	0.36	0.26	0.15	0.08	0.12
Solids	13.27	17.87	62.80	34.13	13.54
Ash	0.37	0.38	0.22	.....	0.52
Sucrose	0.16	0.08	1.62	13.48	3.32
Invert sugar	12.95	15.68	59.76	17.87	9.65
Saccharin	none	none	none	none	none

* Sodium benzoate 0.08%.

None of the samples contained saccharine or salicylic acid. **9580** contained amaranth color and 0.08 per cent. of sodium benzoate.

HAMBURG STEAK.

Thirty-four samples sent by the Dairy Commissioner were examined for preservatives. None contained boric acid, and five no sulphurous acid. Fifteen samples contained less than 2.5 mgms. of sulphurous acid per kilogram, while 13 contained this acid in considerable amount as follows:

No.	Sulphurous Acid mgms. per kilo.	No.	Sulphurous Acid mgms. per kilo.
11637	876.8	11704	368.0
11640	736.0	11706	1740.8
11641	806.4	11707	1875.2
11646	492.8	11710	3513.6
11647	124.8	11712	531.2
11649	2422.4	11721	1628.8
11701	761.6		

These amounts of sulphurous acid are very excessive, and indicate a widespread use of this preservative in comminuted meats that is not without danger to the public health.

No. **11713** had a decided putrid odor when received by us, and was totally unfit for human food.

CORDIALS.

Twenty-seven samples of cordials, brandies and liqueurs have been examined and the results are given in Table XV.

Products of this type have been examined in this laboratory on previous occasions, notably in 1901 and 1914, and their substance and quality need no extended discussion at this time. The solid matter in them consists almost wholly of cane sugar or its derivative, invert sugar, or mixtures of the two sugars. Five samples by their considerable plus polarization at 87° are shown to contain glucose or starch sugar. The coal-tar colors used are of the permitted group except in one case, No. 8155, which contained the unpermitted color magenta. The use of permitted colors does not, however, relieve the manufacturer of the obligation to state the fact of their presence when used. Delinquency in this respect is shown in a number of instances; but in some of these the goods

TABLE XV—ANALYSES OF

Station No.	Brand	Price per bottle. cents
8114	Creme de Menthe Glaciale. P. Garnier, Enghien, France	70
8130	American Creme de Menthe. M. R. Stern, New York	25
8147	Creme de Menthe, in bulk. Johnson Co.,[2] New Haven	25
8149	Creme de Menthe, Liqueur Superfine. Edouard Riviere	10
8151	Creme de Menthe Cordial Superior Quality	20
8158	Creme de Menthe, in bulk	30
8159	Creme de Menthe. Charles Jacquien et Cie	25
8145	Old Abbey Cordialized Apricot Brandy. California Fruit Prod. Co., New York	25
8157	Apricot Cordial. Johnson Co.,[2] New Haven	25
8156	Wild Cherry Cordial. Johnson Co.,[2] New Haven	25
8133	Gilbert's Grenadine Cordial. John Gilbert & Sons, New Haven	35
8146	Anisette Cordial Superior Quality. Hartford Distillery Co., Hartford	25
8131	Crême de Cèrisès. E. Cusenier, Paris	20
8132	Veritable Cherry Liqueur. E. Cusenier, Paris	20
8139	Meggy-Lelke Weichsel-Cherry Liquor. Schrank Béla es Ödön, Esztergom, Hungary	52
8134	Curacoa Sec. E. Cusenier, Paris	20
8135	Creme de Roses. E. Cusenier, Paris	20
8150	Creme de Rose, Superior Quality. French & Italian Imp. Co., New Haven	10
8153	Creme de Rose. New England Cordial and Importing Co	20
8136	Grande Liqueur Saint-Martial. P. Bardinet, Bordeaux	20
8137	Kummel. John Gilbert & Son, New Haven	20
8140	Bazilika Ukör, Schrank Béla es Ödön, Esztergom, Hungary	50
8154	Creme de Coffee Cordial. New England Cordial & Importing Co	20
8155	Creme de Violet. New England Cordial & Importing Co	20
8138	Forbidden Fruit Liqueur. Louis Bustanoby, New York	50
8152	Imperial Peach Cordial. Henry H. Shufeldt & Co., Peoria, Ill	15
8148	Monopol Vodka. Domestic Product. Russian Monopol Co., Brooklyn, N. Y	15

[1] Napthol Yellow S and Light Green S F Yellowish, permitted coal-tar dyes.
[5] Declared alcohol 42%. [6] Declared artificially colored. [7] Declared alcohol 34%
[10] Polarization @ 87° = +14.4. [11] Polarization @ 87° = +16.0.

were not purchased in the original containers. The alcoholic distillates in all cases were examined for the presence of methyl (wood) alcohol but none was detected. Monopol Vodka is a clear, colorless liquid possessing the odor and taste of raw distilled spirit, which the partial analysis indicates it to be.

INFANT FOODS.

Two well-known brands, not previously examined by this Station, were analyzed.

CORDIALS, BRANDIES AND LIQUEURS.

Volume of contents, fl. ozs.	Specific Gravity @ 15.6 °C.	Alcohol by Volume %	Total Solids %	Sucrose %	Reducing Sugar as Invert %	Polarization		Temp. °C.	Color
						Direct °V	Invert °V		
8.3	1.1410	29.30	41.21	40.89	.....	+41.7	—12.5	20	None
6.6	1.1121	18.76	31.85	31.60	.....	+31.8	—10.1	20	N.Y.S&L.G.SFY.[1]
7.3	1.1110	23.86	33.41	19.00	13.48	+15.2	—10.0	20	" "
1.9	1.1056	11.90	28.69	23.34	4.76	+23.7	—7.3	20	" " [6]
2.3	1.0728	20.15	29.94	Present	.....	+43.4	+13.6[8]	19	" "
7.2	1.0718	26.36	25.73	22.70	2.76	+22.3	—7.8	20	" "
7.9	1.1679	15.66	41.22	40.52	.....	+41.0	—12.8	20	" " [6]
7.6	1.1029	28.88	32.05	14.33	17.60	+8.6	—10.3	21	Natural
7.3	1.0940	17.88	27.78	.....	26.98	—7.0	—7.0	21	"
7.5	1.1088	13.60	29.44	7.36	20.00	+1.6	—8.1	21	"
6.9	1.3082	4.76	64.16	.....	61.92	—19.8	—19.8	21	Archil
13.2	1.0385	24.32	16.65	15.33	.....	+15.2	—5.1	21	None
1.7	1.1555	25.50[4]	43.48	31.63	10.50	+28.6	—13.2	21	Natural
1.5	1.0617	25.60	21.12	.....	18.00	—5.8	—6.1	21	"
3.2	1.0994	28.60	32.64	.....	30.72	—8.6	—8.6	21	"
1.1	1.0971	38.70[5]	36.96	35.79	.....	+37.1	—10.2	21	Unidentified[6]
1.6	1.1257	32.25[7]	40.65	39.30	.....	+39.4	—12.5	21	Cudbear[6]
2.5	1.0680	26.20	24.20	Present	.....	+30.0	+7.7[8]	21	Amaranth
2.4	1.0704	25.00	24.41	Present	.....	+31.8	+9.0[9]	21	Amaranth[6]
1.9	1.0935	41.00	37.07	27.39	7.56	+33.0	—3.2	21	None
1.6	1.0823	41.20	35.36	31.47	3.25	+34.0	—7.6	21	None
2.9	1.1068	35.40	36.72	0.74	35.72	—9.2	—10.8	21	Natural
2.3	1.0832	22.95	26.34	Present	.....	+34.8	+12.0[10]	21	Natural
2.5	1.0694	23.95	24.71	Present	.....	+32.6	+9.6[11]	21	Magenta[6]
1.9	1.0549	37.20	27.19	12.26	13.44	+8.2	—8.0	21	Unidentified. Coal-tar
2.4	1.0766	16.20	22.98	1.35	20.28	—6.6	—8.4	20	Vegetable[6]
3.7	0.9463	43.20	.....	.....	.....	.....	.....	..	None

[1] Statement: Imported. [3] Polarization @ 87° = +19.2. [4] Declared alcohol 26%
[6] Polarization @ 87° = +13.6. [9] Polarization @ 87° = +15.2.

5576. *Neave's Food for Infants*, J. R. Neave and Co., Fordingbridge, Eng. Wholesale price 30 cents per 16 oz.

5577. *Savory and Moore's Food for Infants and Invalids*, Savory and Moore, London, Eng. Wholesale price 27 cents per 10 oz.

	5576	5577
Water	8.81	6.28
Ash	0.60	0.75
Protein (N x 6.25)	6.94	11.75

	5576	5577
Fat	1.19	1.45
Fiber	0.21	0.12
Nitrogen-free extract	82.25	79.65
Starch	70.42	69.19

Neave's Food is essentially a baked flour, while the *Savory and Moore Food* is composed of wheat flour and malt. Both brands contain very large percentages of starch. Owing to the diastatic ferment present most of the starch in *Savory and Moore's Food*, if prepared according to directions, would be converted into soluble forms, chiefly dextrins. In *Neave's Food* such would not be the case as no ferment is present.

JELLY AND JUNKET POWDERS.

The descriptions of three new brands and their analyses follow:

9570. *Falconjel, Raspberry.* Falcon Packing Co., New York. "Composed of geletine, sugar, citric acid, artificial flavor and vagetable color." Cost 13 cts. per 6.3 oz.

9568. *Jiffy-Jell, Orange.* Waukesha Pure Food Co., Waukesha, Wis. "A mixture, vegetable color." Cost 13 cts. per 3.3 oz.

9569. *Nesnah, Lemon Flavor.* The Junket Folks, Little Falls, N. Y. "Contains U. S. certified color." Cost 10 cts. per 4.0 oz.

	9570	9568	9569
Water	2.43	3.28	0.15
Ash	0.15	0.21	0.35
Gelatin (N x 5.55)	7.66	8.05	none
Cane sugar	88.35	88.11	98.82
Undetermined	1.41	0.35	0.68
Color	*	**	***

* Lichen color, probably cudbear. ** Cochineal. *** Napthol Yellow S and Orange I.

These three samples substantially satisfy their claims, although of course it is incorrect to class cochineal as a "vegetable" color. *Nesnah* contained rennin or a rennet-like substance.

Granting the convenience of such preparations, purchasing sugar in the form of a jelly powder is rather an expensive practice.

MILK.

Three hundred and ninety samples sent by the Dairy Commissioner were analyzed. Of these 132 conformed to the legal

TABLE XVI.—WATERED MILKS.

No.	Dealer.	Solids.	Fat.	No.	Dealer.	Solids.	Fat.
	Bloomfield:				Orange:		
12302	F. Chiaramonti..	11.08	3.6	12144	E. J. Cronin.....	10.25	3.1
12199	J. Viicciaido.....	8.09	2.6	11730	S. G. Grillo.....	3.72	1.3
12300	" "	8.99	3.0	12143	Wasily Paray....	8.18	2.4
12301	" "	9.12	3.0		Shelton:		
	East Lyme:			11939	P. Imbimbo.....	11.28	4.3
11679	Koss Bros.,.....	11.21	3.6		Southbury:		
	Guilford:			11981	J. N. Benson....	11.62	4.1
12133	Frank Haggerty..	11.66	3.7	11975	H. B. Davis.....	6.20	2.1
12136	R. E. Scranton...	11.26	3.9	11976	" "	9.07	2.4
12138	" " ...	11.23	3.6	11978	E. Mellane.....	12.05	4.3
12139	Willard Scranton.	10.57	3.0	11979	Mrs. Nora Rogers	8.76	2.3
12140	" "	11.08	3.9	11980	" " "	11.90	4.0
	Jewett City:				So. Norwalk:		
11854	W. B. Frink, Est.	11.40	3.5	11772	J. H. Crosby....	10.87	3.2
11855	" " "	11.73	3.7	12132	J. H. Wempe.....	11.12	3.4
	Killingly:				Stonington:		
12111	Walter Chase....	11.02	3.6	12152	J. B. Crowley....	11.24	3.3
11650	(Unknown).....	8.15	2.5		Watertown:		
	Meriden:			12018	A. Brazee.....	11.30	3.5
12089	W. A. Reed.....	10.28	3.0		Westport		
12090	" "	10.59	3.1	11973	Robt. Dykman...	11.65	3.9
	Noroton:			11974	" "	11.65	3.8
12029	James H. Mead..	11.60	4.6		Willimantic:		
12030	" " "	10.20	4.0	12173	G. W. Andrews..	11.01	3.1
	No. Franklin:			11669	Reinstein Bros...	9.41	2.9
12268	J. Ries.....	12.07	4.2		Woodbury:		
	Norwich:			11946	T. Madin.....	11.43	3.6
11653	J. J. Harrington..	10.23	3.4	12000	B. F. Ricker....	10.52	3.2
11654	" "	9.95	3.0				
11655	" "	10.29	3.2				
11656	" "	10.19	3.2				
11399	(Unknown).....	10.11	2.8				

standards, 216 were below the standard in one or more respects, 44 were watered, 6 were skimmed and 2 were both skimmed and watered. Of the sub-standard samples, in which no watering or skimming was detected, 9 were deficient in fat, 3 in solids and fat, 118 in solids-not-fat, 42 in solids and solids-not-fat, and 44 in solids, fat and solids-not-fat. The large proportion of adulterated and sub-standard samples is no indication of the quality of the milk generally sold in this state, as all of these samples were taken because of some suspicion as to their purity. That there is an abundance of milk of good quality sold in the state is shown by the composition of the 132 samples which conformed to the standards. These contained from 11.75 to 14.49 per cent. of

solids and from 3.3 to 6.0 per cent. of fat, with averages of 12.61 and 4.03 per cent., respectively. In 57 per cent. of these samples the fat ranged from 3.3 to 4.0, in 30 per cent. from 4.0 to 4.5, in 7 per cent. from 4.5 to 5.9, and in 6 per cent. was over 5.0 per cent.

Table XVI shows the composition of the watered milks and the names of the dealers selling them.

The following tabulations give similar data for the skimmed and the skimmed and watered milks:

SKIMMED MILKS.

No.	Dealer.	Solids.	Fat.
12161	Mansfield Center: H. E. Avery	11.98	3.2
11691	S. J. Nacsin	10.95	2.6
12169	No. Franklin: J. Ries	11.17	2.8
11457	Southington: W. S. Crosby	10.97	2.6
12130	Sterling: Richard Fortune	11.74	2.8
11391	Willimantic: (unknown)	12.50	3.1

SKIMMED AND WATERED MILKS.

12027	Noroton: T. M. Collins	8.12	2.2
11875	Somers: E. H. Pease	9.60	2.1

SAUSAGE.

Twenty-one samples of pork sausage, sent by the Dairy Commissioner, were tested for added starch. In sixteen of these the starch ranged from 0.16 to 0.39 per cent. In the remaining five samples the percentages were much higher, indicating that starch had been added to the sausage meat. The adulterated samples were as follows:

No.	Dealer.	Starch. %
11724	Thos. Rutendo, Hartford	4.63
11731	Meriden Market, Meriden	2.75
11735	Fulton Market, Waterbury	2.55
11738	Palace Market, Waterbury	1.64
11739	Public Market, Waterbury	2.43

SPICES.

In 1916 we inspected spices sold in package form; this year the inspection has been concerned chiefly with bulk goods. Fifty-two samples, sent by the Dairy Commissioner, have been examined.

Applying the standards rigidly 1 sample of black pepper, 10 of cayenne, 4 of cloves, 2 of ginger and 1 of white pepper departed

TABLE XVII.—SPICES.

No.	Dealer.	Ash.		Starch.	Crude fiber.	Non-volatile ether extract.
		Total.	Insol. in acid.			
	Black Pepper.					
11784	James Van Dyk Co., New York (New Haven store)	6.43	1.40	36.03	11.47	7.72
11802	Ross W. Weir & Co., New York (W. B. Eastman, New Milford)	6.17	1.11	33.96	12.69	8.19
11783	In bulk (F. H. Davis, New London)	6.35	1.35	36.62	12.26	7.90
11788	" " (Flemming & Cowan, Hartford	**7.12**	1.15	28.41	15.00	8.31
11795	" " (M. Epstein, So. Norwalk)	6.76	1.30	36.84	11.76	7.51
11798	" " (W. F. Brennan, Torrington)	5.31	0.71	39.60	11.06	7.29
11806	" " (Geo. B. Clark, Salisbury)	5.07	0.57	37.57	12.16	7.13
11829	" " (Direct Importing Co., New Haven)	5.73	0.65	41.65	9.93	6.80
11840	" " (Pure Food Market, New Haven)	6.72	1.26	32.76	13.95	8.70
11900	" " (Yale Tea & Coffee Co., Waterbury)	4.56	0.25	34.11	13.52	6.51
	Cayenne Pepper.					
11793	East India Tea Co. (So. Norwalk store)	5.57	0.20	0.62	22.12	17.83
11800	McCormick & Co., Baltimore (Jos. Gaven, Torrington)	**7.50**	**1.52**	1.43	24.08	**10.02**
11782	In bulk (W. F. Barrows, New London)	6.17	**0.57**	1.27	25.94	16.34
11790	" " (Newton, Robertson & Co., Hartford)	**6.61**	**0.65**	0.73	24.40	17.00
11797	" " (A. Davey & Co., So. Norwalk)	6.30	**0.52**	1.07	24.39	16.41
11803	" " (Geo. B. Clark, Salisbury)	**7.43**	**1.11**	0.53	25.15	10.22
11824	" " (Direct Importing Co., Mystic)	6.44	0.50	0.51	19.34	15.00
11830	" " (" " " Bridgeport)	6.37	0.48	0.96	20.65	**13.51**
11833	" " (Village Store Co., Bridgeport)	**7.81**	**0.62**	0.67	24.43	**14.87**
11835	" " (Union Pacific Tea Co., Bridgeport)	**6.97**	**1.20**	1.07	25.65	15.68
11836	" " (Mohican Co., New Haven)	6.06	0.15	0.70	21.39	19.21
11837	" " (Shartenberg & Robinson Co., New Haven)	5.35	0.15	1.17	18.82	**12.36**
11838	" " (Direct Importing Co., New Haven	6.32	0.10	1.07	14.85	**11.11**
11841	" " (Pure Food Market, New Haven)	6.42	0.40	0.87	21.91	16.61
11842	" " (F. J. Markle, New Haven)	5.60	0.38	0.81	24.76	16.82
11844	" " (Grand Union Tea Co., New Haven)	5.81	0.50	0.81	25.11	16.73
11847	" " (Yale Tea & Coffee Co., Waterbury)	**8.56**	**0.72**	1.46	27.73	**3.94**
	Cloves.					
11786	In bulk (S. Satriano, Hartford)	6.26	0.25	..	8.33	17.80
11792	" " (James Butler, Stamford)	6.55	0.32	...	9.42	14.21
11799	" " (W. F. Brennan, Torrington)	6.79	0.60	...	**13.88**	**6.40**
11826	" " (Direct Importing Co., Mystic)	6.25	0.48	...	9.08	17.34
11827	" " (Gager Crawford Co., New London)	5.96	0.27	...	**10.73**	14.81
11839	" " (John Gilbert & Son, New Haven)	7.62	**0.57**	...	8.17	19.86
11845	" " (Carlson Tea Co., New Haven)	6.42	0.39	...	9.79	15.12
11848	" " (Yale Tea & Coffee Co., Waterbury)	6.82	**0.71**	...	9.55	16.90
	Ginger.					
11787	In bulk (S. Satriano, Hartford)	5.12	0.93	49.56	...	...
11794	" " (M. Epstein So. Norwalk)	4.90	0.57	48.66	...	...
11801	" " (H. M. Hoag, Sharon)	5.11	0.70	51.36	...	...
11805	" " (Geo. B. Clark, Salisbury)	**6.51**	0.52	49.90	...	...

Figures in boldface indicate a departure from the standard.

TABLE XVII.—SPICES—*Continued.*

No.	Dealer.	Ash.		Starch.	Crude fiber.	Non-volatile ether extract.
		Total.	Insol. in acid.			
	Ginger.					
11807	In bulk (F. S. Roberts, New Hartford)	5.17	0.90	49.05	...	...
11828	" " (Direct Importing Co., New Haven)	**6.50**	0.62	48.26	...	...
11831	" " (" " " Bridgeport)	5.57	0.66	49.44	...	...
11843	" " (Pure Food Market, New Haven)	5.95	1.00	49.05	...	...
11846	" " (Great Atl. & Pac. Tea Co., Waterbury)	4.60	0.27	51.52	...	...
11849	" " (Yale Tea & Coffee Co., Waterbury)	4.01	0.46	52.73	...	...
	White Pepper.					
11789	Chas. G. Lincoln & Co. (Brown, Thomson & Co., Hartford)	1.21	0.15	55.46	4.27	7.52
11785	In bulk (Buckley & Reardon, Hartford)	1.22	0.13	53.72	3.93	7.10
11791	" " (James Butler, Stamford)	2.03	0.50	55.23	4.38	7.96
11796	" " (Andrew Davey & Co., So. Norwalk)	1.17	0.10	55.74	4.39	7.31
11804	" " (Geo. B. Clark, Salisbury)	1.49	0.06	58.61	4.05	7.04
11825	" " (Direct Importing Co., Mystic)	**5.16**	**0.52**	47.24	**7.57**	7.49
11834	" " (Davey Bros., Bridgeport)	1.01	0.07	55.25	3.76	6.97

Figures in boldface indicate a departure from the standard.

from the standard in some respect. Many of these variations, however, are trivial, and only the following seven can be considered as seriously adulterated:

Cayenne pepper. Nos. **11800, 11803, 11837, 11838** and **11847.**

Cloves. No. **11799.**

White pepper. No. **11825.**

The spices sold in Connecticut market, both in package form and in bulk, are on the whole of satisfactory quality. The adulterations found are due chiefly either to insufficient cleaning of the crude spices, or to careless storage conditions whereby the spice value of the product is impaired.

TEMPERANCE BEVERAGES.

The quite general enactment of laws prohibiting the sale and even the use of intoxicating drinks, makes the analysis of beer substitutes a matter of some importance. Four such brands have been examined this year as follows:

8163. *Anzac Cereal Beverage*, Anzac Co., Boston, Mass. Cost 10 cts. per 12 fl. oz.

TABLE XVIII.—VINEGAR.

No.	Brand.	Acidity.	Solids.
	Cider Vinegar.		
11909	A. & P.	4.44	1.91
11926	American Grocers Society. (A. G. S.)	4.01	1.99
11922	Apple Product Co.	4.01	2.32
11923	Berkshire Products Co.	4.00	1.82
12050	" " "	3.86	1.78
12032	A. C. Blenner & Co.	4.04	1.93
11914	W. W. Cary & Son	4.32	2.08
11919	" " "	4.20	2.09
12038	Cascade Cider Co (C. C. C.)	4.66	2.31
11910	John T. Doyle Co. (Country Club)	4.24	1.90
11935	Lewis DeGroff & Son (Health)	5.12	2.29
11920	Duffy Malt Co. (Duffy's Gold Seal)	4.04	1.98
12036	Eagle Oil & Supply Co. (Sumner)	4.00	1.74
11912	Empire Bottling Works (Empire)	4.01	1.76
11924	Empress Mfg. Co. (Howard)	4.00	1.94
11925	Glautz & Sulkind (G. & S.)	4.57	2.03
12037	Humphrey & Cornell	4.06	1.90
11933	Francis H. Leggett & Co. (Premier)	5.12	2.72
12043	D. E. Mowry Co.	4.60	1.92
12042	Pen Yan Cider Co. (Parson's)	4.80	2.60
11918	Rocco	4.32	1.91
12011	Scutonia	2.04	2.97
11917	Silver Boy Packing Co.	4.28	2.21
12061	Silver Lane Pickling Co.	4.60	2.30
11934	Standard Pickle Co.	4.16	1.83
12063	J. A. Thompson & Son (XXX)	3.84	1.93
12044	R. C. Williams & Co. (Robin Hood)	5.46	2.20
12010	E. H. Woodworth	3.98	1.60
11944	" "	4.00	1.64
11915	Sold by W. R. Bailey, New Haven	4.72	3.26
12031	" " B. Halpert, New Haven	4.00	2.00
12034	" " Kobler Bros., New Haven	4.24	2.48
12035	" " E. Casher & Son, New Haven	3.98	1.81
12039	" " E. J. Bates, New London	4.24	1.70
12041	" " A. Wachanasky, New London	5.18	2.04
12062	" " A. Fronz, Meriden	4.04	1.88
12060	" " G. Galamandra, Meriden	3.72	1.98
12064	" " J. A. Collins, Meriden	3.28	3.27
	Distilled Vinegar.		
12040	Sold by A. Gordon, New London	4.04	0.25
	Distilled and Molasses Vinegar.		
11913	John T. Doyle Co.	3.96	0.36

8161. *Bevo*, Non-Intoxicating, Anheuser-Busch Brewing Association, St. Louis, Mo. Cost 12 cts. per 10 fl. oz.

9162. *Iron Brew*, Non-Alcoholic, The Mass and Waldstein Extract Co., Newark, N. J. "Colored with burnt sugar." Cost 5 cts. per 7.3 fl oz.

9590. *Wesco*, Temperance Beverage Co., Pelham, N. Y. "Alcohol less than ½ per cent." Cost 15 cts. per 11.5 fl. oz.

	8163	8161	8162	9590
Alcohol by volume	0.42	0.38	0.38	0.44
Solids	5.92	6.20	8.37	4.91
Ash	0.21	0.11	0.10	0.18
Direct reducing sugars	2.27	2.42	6.90	1.55
Total reducing sugars	5.41	5.79	7.72	4.15

No saccharin, benzoic or salicylic acids were found in any of the above.

VINEGAR.

Forty samples sent by the Dairy Commissioner were examined. The state standard for vinegar sets limits only for acidity and solids, 4.00 and 1.60 per cent., respectively, and only these determinations were made in this examination. Thirty-five samples satisfied the standard, and five were deficient in acidity, the percentages found ranging from 2.04 to 3.84.

MISCELLANEOUS FOODS.

EGGS. Six samples of eggs, sent by the Dairy Commissioner, and purchased for "fresh eggs," were found to be misbranded.

SUGAR. Of four samples of granulated sugar, sent by the Dairy Commissioner, three were pure, but the fourth contained about 3.5 per cent. of corn starch. A sample of brown sugar from the same source contained 86.87 per cent. of saucrose, and was not adulterated.

OVALTINE. *Ovaltine, Tonic Food Beverage.*. A. Wander, London, Eng. "A concentrated extraction from malt, milk and eggs, flavored with cocoa." "Is rich in lecithin, the assimilable organic compound of phosphorus. It is thus a valuable article of food in cases of mental and nervous exhaustion."

Water	1.03
Ash	3.52
Protein (N x 6.25)	12.75
Fat	5.58
Fiber	0.64
Nitrogen-free extract	76.48
Lecithin phosphoric acid	0.10
Reducing sugars (chiefly maltose, lactose, dextrose and dextrins)	70.01

Active amylase	present
Starch	trace
Calories per 100 gms	407

The product appears to be composed of the foods claimed. The small amount of lecithin phosphoric acid present, 0.10 per cent, hardly seems to justify the claim that the food is "rich in lecithin," or that it is "a valuable article of food in cases of mental and nervous exhaustion."

TAPIOCA. *Sunbeam Pure Food Small Pearl Tapioca, German Sago Style.* Austin, Nichols and Co., New York. Cost 12 cts. per 14 oz.

Water	13.51
Ash	0.16
Protein (N x 6.25)	0.56
Fat	0.05
Fiber	0.05
Starch	85.67
Calories per 100 gms	345

COTTEN SEED BREAD. This is a "war" bread, made according to the following recipe for one loaf:

⅔ cupful cotton seed meal
2⅓ cupfuls bread flour
1 teaspoonful salt
1 tablespoonful sugar
½ cake yeast
1 cupful lukewarm liquid (water, milk, or equal parts of each).

Its composition follows and that of baker's bread for comparison.

We are indebted for the above recipe and sample to the Bureau of Chemistry, U. S. Department of Agriculture.

WHEAT-A-LAXA BREAD. Made by the S. S. Thompson Co., New Haven. "Natural Grain, Laxative, Whole Wheat."

BISCUITS. Three samples were analyzed as follows:

8122. *Homo Whole Wheat Biscuit*, National Biscuit Co., New York, Cost 10 cts. for 66 biscuits weighing 5.9 oz.

8129. *Whole Wheat Crackers*, Loose-Wiles Biscuit Co., Boston, Mass. Cost 15 cts. for 7.4 oz.

8125. *India Biscuit* (formerly *India Digestive Biscuit*), New England Cereal Co., South Norwalk, Conn. Cost 25 cts. for 20 biscuits weighing 11 oz.

	Cotton Seed Bread.	Wheat Bread.	Wheat-A Laxa Bread.	8122	8129	8125
Water	38.02	36.44	33.60	9.56	10.23	8.67
Ash	2.09	1.43	2.17	3.47	3.18	5.02
Protein	13.51	7.65	8.60	9.13	9.13	12.81
Fat	1.63	1.98	3.75	8.10	4.33	2.24
Nitrogen-free extract	*44.76*	*52.60*	*51.90*	69.10	72.80	66.03
Fiber	...	...	...	0.64	0.33	5.23
Calories per 100 grams	248	258	276	386	367	336

NUT MARGARINE. *Nut Margarine, Coco-Nut Brand,* The Nucoa Butter Co., New York "Free from animal fats." "Contains 1-10 per cent of benzoate of soda." Cost 30 cts. per lb.

Water	7.65
Sodium benzoate	0.10
Reichert-Meissl No.	7.25
Refractive index @ 40° C.	1.4502

Phytosterol, cocoanut oil and possibly peanut oil were present, cholesteral and cotton seed oil were not present.

The product consists chiefly of cocoanut oil with possibly some peanut oil. No animal fat is present. This is a wholesome preparation and at present butter prices might well be substituted for that article. The presence of benzoate of soda is objectionable as well as unnecessary.

FLOUR. *Good Health Flour*, A. B. Klar, Canal Dover, O. "Contains muscle, brain, nerve, bone and tooth elements."

Water	12.01
Ash	1.68
Protein (N x 6.25)	15.13
Fat	3.30
Fiber	1.62
Nitrogen-free extract	66.26
Starch	53.83
Phosphoric acid	0.86
Calories per 100 gms.	355

Any good whole wheat flour justifies the above claim quite as well as this particular brand.

OYSTERO. *Oystero*, Oyster Broth Powder, J. S. Darling and Son, Hampton, Va. Carton containing three tubes weighing together about 0.5 oz., and each claimed to be "sufficient to make a pint of oyster broth," cost 25 cts.

Water	3.77
Ash	11.39
Protein (N x 6.25)	52.50
Fat	9.20
Nitrogen-free extract	23.14
Sodium chlorid	3.10
Boric acid	none

The above analysis agrees well with that of dried oyster meat and the preparation appears to be true to name.

GRISSIN. *Piemont Toreador Grissin, Salted, Italian Bread Sticks*, A. Angononoa, New York. Cost 13 cts. per 3.7 oz.

SPLIT PEAS. *Mission Garden Split Peas.* Cost 36 cts. per 32.0 oz.

	Grissin.	Split Peas.
Water	10.10	11.33
Ash	3.59	2.88
Protein (N x 6.25)	11.50	23.44
Fat	7.21	1.01
Fiber	0.21	1.06
Nitrogen-free extract	67.39	60.28
Chlorin	1.39	...
Calories per 100 grams	380	344

RYZON, The Perfect Baking Powder, General Chemical Co., New York. "Monosodium phosphate, sodium bicarbonate, starch." Cost 18 cts. per 8.6 oz. It contained moisture 4.08, phosphoric acid 22.96, carbonic acid 12.73, residual carbonic acid 0.45, available carbonic acid 12.28, sodium oxid 20.32, sulphuric anhydrid 0.22, starch 31.68 per cent., calcium oxid a trace. It is composed, therefore, of about 38.80 per cent. monosodium phosphate, 24.3 sodium bicarbonate, 31.7, starch, 0.4 sodium sulphate, 4.08 moisture and 0.74 undertermined.

8120. *Vegex*, A Vegetable Extract, J. W. Beardsley's Sons, New York, "Made entirely of vegetable products. Contains 35% protein." Cost 25 cts. per 2 oz.

8121. *Vegex Cubes;* same manufacturer as above. Cost 15 cts. per box of 12 cubes, each weighing 0.16 oz.

	8120	8121
Moisture	28.24	7.22
Protein (N x 6.25)	33.00	18.88
Ash	25.73	64.59
Chlorin	7.86	34.59

	8120	8121
=Sodium chlorid	12.96	57.02
Creatinin	none	none
Nitrates	none	none

8127. *Kremette Ice Cream Dressing*, G. F. Heublein and Bro., Hartford. "A Delicious and Palatable Adjunct to Vanilla Ice Cream. Artificially colored." "Alcohol 20%." Price 35 cts. per 6.1 fl. oz.

Spec. grav. @ 15.6° C	1.1609
Alcohol by volume	20.52
Solids	43.24
Sucrose	35.49
Invert sugar	6.40
Ash	0.02
Color	archil or cudbear

8115. *Feinste Schlag-Sahne (Sterilized Whipped Cream)*, C. Mäden Stubben, Bremen, Germany. "Absolutely pure and free of all ingredients." (Evidently an erroneous translation.) Cost 14 cts. per 8 oz.

Water	62.22
Solids	37.78
Ash	0.56
Protein (N x 6.25)	2.52
Lactose	2.25
Fat	32.05
Borax, benzoate, and salicylate	none

THE DRYING OF VEGETABLES BY MEANS OF THE ELECTRIC FAN.

The drying of vegetables and fruits by artificial heat or by the sun's heat is an old practice, but recently in the effort to conserve food of a perishable nature, drying by means of an unheated current of air from an electric fan has been recommended.

While the method has certain advantages, for instance, a better preservation of flavor and color, doubts rose in our minds as to the keeping qualities of products thus prepared. Accordingly we have tested the method with a number of vegetables, with the following results. For comparison several samples were also dried with artificial heat and one by exposure to the sun.

The drying period which has been recommended generally is

far too short. During our first tests the weather conditions were very unfavorable for successful drying, and our drying periods were longer than would have been required in less humid weather.

After drying, the vegetables were conditioned for a few days as directed, and were then placed in card-board boxes which were tightly wrapped in paraffined paper. The contents of the boxes were examined at first at two-week, later at monthly intervals for the presence of mold or insect infestation.

1. *Rhubarb*, June 1. Thoroughly washed, superficial moisture removed with a clean towel, and the stalks cut into 1–16 in. slices. Dried 15¾ hrs., probably unnecessarily long. In good condition Nov. 7.

2. *Rhubarb*, June 1. Treated as above but dried with artificial heat. dried 16⅜ hrs. In good condition Nov. 7.

3. *Asparagus tips*, June 2. Asparagus washed, surplus moisture removed, and tougher more fibrous portion cut away and dried separately. Tips cut into ½ in., fibrous part into ⅛ in. pieces. Drying very prolonged, as sample was not cut fine enough, and the air was exceedingly humid. Insect infestation noted on Oct. 2.

4. *Asparagus, fibrous part*, June 2. Prepared as above, and dried with artificial heat. In good condition Nov. 7.

5. *Asparagus tips*, June 2. Treated as in No. 4. In good condition Nov. 7.

6. *Carrots*, June 2. Sliced very thin, about 1/32 in. Dried in 3 hrs. In good condition Nov. 7.

7. *Spinach*, June 13. Thoroughly washed, and passed through a slicer, stems and all. Stems proved very hard to dry and were later removed. Dried in about 10 hrs. Slight mold shown on Oct. 2.

8. *Spinach*, June 13. Treated as No. 7, but dried with artificial heat in about 3 hrs. Slight mold shown on Oct. 2.

9. *Spinach*, June 13. Whole leaves, dried with heat. After several hours drying it was necessary to remove the leaf stems. In good condition Nov. 7.

10. *String beans*, June 18. Beans were stringed, washed and blanched in boiling water for 10 min. They were then drained and cut lengthwise for drying. Drying very prolonged. Mold developed after one month.

10*a*. *String beans*, June 18. Same as No. 10, except that beans were cut crosswise into 1 in. pieces. Drying very prolonged. Badly molded on June 30.

11. *String beans*, June 18. Treated same as No. 10, except that artificial heat was used. Drying very prolonged. In good condition Nov. 7.

12. *String beans*, June 18. Treated same as No. 10a, except that artificial heat was used. Drying very prolonged. In good condition Nov. 7.

13. *Swiss chard*, June 26. Leaves sliced fine, the chopped stems being

COMPOSITION OF DRIED VEGETABLES.

No.		Water.	Ash.	Protein. (N x 6.25).	Fiber.	Nit.-free extract.	Fat.
1	Rhubarb, fan.....	16.70	13.00	13.06	11.35	43.83	2.06
2	Rhubarb, heat.....	13.55	12.98	13.94	13.41	44.68	1.44
3	Asparagus tips, fan.....	19.69	8.13	32.06	7.74	30.54	1.84
4	Asparagus, fibrous, heat..	15.90	7.57	17.31	14.97	43.18	1.07
5	Asparagus tips, heat.....	16.51	8.32	33.31	8.32	31.04	2.50
6	Carrots, fan.....	15.41	7.54	8.63	7.92	60.10	0.40
7	Spinach, fan.....	9.96	22.00	30.88	8.74	25.55	2.87
8	Spinach, heat.....	9.34	22.22	30.50	9.22	24.99	3.73
9	Spinach, whole leaves, heat	10.54	19.65	29.63	5.81	29.51	4.86
10	String beans, long, fan....	15.57	6.91	18.38	13.99	44.37	1.78
11	String beans, long, heat...	12.86	6.32	20.19	11.72	47.06	1.85
12	String beans, short, heat..	13.60	6.36	20.00	12.01	46.36	1.67
13	Swiss chard, fan.....	13.25	20.68	24.06	8.14	30.47	3.40
14	Swiss chard, sun.....	12.74	20.71	24.63	6.44	32.01	3.47
15	Swiss chard, heat.....	12.72	14.81	28.63	6.43	32.69	4.72
16	Peas, fan.....	14.12	3.38	24.25	5.71	51.38	1.16
17	Peas, fan.....	14.01	4.00	27.50	8.58	43.34	2.57
18	Baked beans, fan, heat...	7.70	3.19	24.50	4.55	58.90	1.16

kept separate. Leaves dried in 6 hrs., stems taking longer. In good condition Nov. 7.

14. *Swiss chard*, June 26. Treated same as No. 13, but dried in greenhouse with sun's heat. Drying much slower than with fan. In good condition Nov. 7.

15. *Swiss chard*, July 8. Leaves stripped from stems and the whole leaves dried with heat. Dried in about 6 hrs. In good condition Nov. 7.

16. *Peas*, July 12. Peas shelled and passed through meat grinder. Dried in about 7 hrs. Insect infestation found on Oct. 2.

17. *Peas*, July 13. Treated as No. 16. Dried in 12 hrs., somewhat over dried. Insect infestation found on Sept. 1.

18. *Baked beans*. Beans baked, then dried with fan and current of hot air. In good condition Nov. 7.

To summarize, we find that only 3 of 9 samples dried without heat by the electric fan were in good condition after from 4 to 5 months, while 8 of 9 samples dried with artificial heat and the one sample dried with the sun's heat were free from mold and insect infestation at the end of the same period. On the whole our short experience, therefore, is unfavorable to the cold air, electric fan method of drying.

That the dried vegetables possess high nutritive value is shown by the following analyses of our products. By adding the following parts of water to one part of the dried vegetable the resultant

product would have about the same moisture content as the fresh vegetable: Baked beans, 3, peas 3.5, rhubarb 14, carrots, 7 asparagus 14, spinach 11, Swiss chard 11 and string beans 8 parts.

II. DRUG PRODUCTS.

DRUGS FROM STOCK OF DISPENSING PHYSICIANS.

In the Report for 1916 the analyses of 53 such samples were reported. On the following pages will be found the results with 76 additional samples, completing our first inspection of this class of products.

The names and addresses of the firms represented are shown below:

Bristol Myers Co., Brooklyn, N. Y.
Brewer and Co., Worcester, Mass.
Buffington Pharm. Co., Worcester, Mass.
Daggett and Miller Co., Providence, R. I.
Direct Sales Co., Buffalo, N. Y.
Drug Products Co., New York.
The G. F. Harvey Co., Saratoga Springs, N. Y.
The Harvey Co., Saratoga Springs, N. Y.
Independent Pharm. Co., Worcester, Mass.
C. Killgore, New York.
Maltbie Chemical Co., Newark, N. J.
Moore and Co., Worcester, Mass.
National Drug Co., Philadelphia, Pa.
Norwich Pharmacal Co., Norwich, N. Y.
P. J. Noyes Co., Lancaster, N. H.
The E. L. Patch Co., Boston, Mass.
Polk Calder Co., Troy, N. Y.
Progressive Chemical Co., New Haven, Conn.
Surgeon and Physicians Supply Co., Boston, Mass.
Tailby-Nason Co., Boston, Mass.
The Tracy Co., New London, Conn.
John Wyeth and Bro., Philadelphia, Pa.
Yates Drug and Chemical Co., New York.

In the case of tablets at least half of the number making up the sample were weighed individually. These were then ground into a composite sample and the mixture analyzed. In certain instances only the active drug or drugs were determined, while in others a complete analysis was made.

TABLETS.

Acetasol.

11592. *Acetasol*, made by Daggett and Miller Co.; stock of Dr. F. Schavoir, Stamford. *Claimed;* Acetanilid 50%, caffein

2.5%, sodium salicylate, sodium bicarbonate, sugar of milk and oil of wintergreen q.s. to make 100. *Found;* Weights of 19 tablets ranged from 345.9 to 363.4, average, 353.2 mgms. They contained 44.06% acetanilid, 2.12 caffein, 13.36 sodium bicarbonate and 7.36 sodium salicylate; milk sugar and oil of wintergreen present.

Tablets deficient in acetanilid and caffein.

Ammonium Salicylate Comp.

11588. *Ammonium Salicylate Comp.*, made by Daggett and Miller Co.; stock of Dr. J. G. Stanton, New London. *Claimed per tablet;* Ammonium salicylate 2 grs., caffein 1 gr., camphor ½ gr., acetanilid 1⅓ grs., and Dover's powder 1½ grs. *Found;* Weights of 20 tablets ranged from 405.2 to 454.8, average 425.5 mgms. They contained 27.12% ammonium salicylate, 13.42 caffein and 19.27 acetanilid; camphor present and opium and ipecac (indicating Dover's powder).

Tablets contained in part

	Ammonium Salicylate. grs.	Caffein. grs.	Acetanilid. grs.
Heaviest	1.90	0.94	1.35
Lightest	1.70	0.84	1.21
Average	1.78	0.88	1.26

Tablets deficient in ammonium salicylate and caffein.

Antiseptic Tablets.

11577. *Antiseptic Tablets No. 2*, made by Daggett and Miller Co.; stock of Dr. J. W. Callahan, Norwich. *Claimed per tablet;* Corrosive sublimate 7 grs., citric acid 3.48 grs. *Found;* Weights of 12 tablets ranged from 569.8 to 666.2, average, 603.4 mgms. They contained 56.24% corrosive sublimate, or from 4.94 to 5.78, average, 5.24 grs.

Tablets very variable in weight, all short weight, and deficient in corrosive sublimate.

11619. *Antiseptic Tablets No. 1*, made by Direct Sales Co., stock of Dr. T. F. O'Loughlin, Rockville. *Claimed per tablet;* Corrosive sublimate 7.3 grs., ammonium chlorid 7.7 grs. *Found;* Weights of 12 tablets ranged from 970.8 to 1016.8, average, 983.9 mgms. They contained 47.23% corrosive sublimate, or from 7.08 to 7.41, average 7.17 grs.

Tablets satisfactory.

11558. *Antiseptic Tablets No.* 1, made by the Tracy Co.; stock of Dr. T. J. Connors, West Haven. *Claimed per tablet;* Corrosive sublimate 7.3 grs., ammonium chlorid 7.7 grs. *Found;* Weights of 12 tablets ranged from 1061.9 to 1083.9, average, 1073.3 mgms. They contained 46.57% corrosive sublimate, or from 7.63 to 7.79, average, 7.72 grs.

Tablets satisfactory.

11625. *Alkaline and Antiseptic Tablets (Dr. Seiler's Formula),* made by National Drug Co.; stock of Dr. E. J. Thompson, Hartford. *Claimed per tablet;* Sodium bicarbonate, sodium biborate, sodium benzoate, sodium salicylate, sodium chlorid, eucalyptol, thymol, menthol, oil of sweet birch. *Found;* Weights of 13 tablets ranged from 834.2 to 883.1, average, 863.2, mgms. No specific amounts being claimed only qualitative tests were made. Sodium borate, carbonate, chlorid, salicylate, benzoate and thymol and menthol were found.

Tablets satisfactory in respect to ingredients.

11447. *Antiseptic Germicide,* made by the Maltbie Chemical Co.; stock of Dr. J. L Gilday, Bridgeport. *Claimed per tablet;* Mercuric iodid 3/8 grs., potassium iodid 3/8 gr., sodium bicarbonate 6 grs. *Found;* Weights of 12 tablets ranged from 1040.8 to 1152.6, average 1096.1, mgms. They contained 2.03 mercuric iodid, 2.88 potassium iodid and 94.25 per cent. sodium bicarbonate; so that one tablet contained

	Mercuric iodid. grs.	Potassium iodid. grs.	Sodium bicarbonate. grs.
Heaviest	0.361	0.512	16.88
Lightest	0.326	0.463	15.14
Average	0.343	0.487	15.94

Tablets satisfactory except for large excess of sodium bicarbonate. It is possible, however, that the sampling agent erroneously copied 6 for 16 grs.

Arsenious Iodid Compound.

11445. *Arsenious Iodid Compound,* made by Drug Products Co.; stock of Dr. C. L. Dichter, Stamford. *Claimed per tablet;* Corrosive sublimate 1-64 gr., potassium iodid 2 grs., syr. iron iodid 5 min., sol. arsenic and mercury iodid 2 min., tinct. nux vomica 2 min. *Found;* Weights of 24 tablets ranged from 497.2 to 559.5, average, 534.6, mgms. They contained 5.21 potassium

and 17.10 per cent. iodin; mercury, arsenic and iron present; sample too small for identification of nux vomica. Based on the potassium content, tablets contained 22.12 per cent. potassium iodid, so that heaviest tablet contained 1.91 grs., lightest, 1.70, average, 1.82.

Tablets slightly deficient in potassium iodid.

Aspirin Tablets.

11587. *Aspirin Tablets*, made by Daggett and Miller Co.; stock of Dr. J. S. Stanton, New London. *Claimed per tablet*; 5 grs. *Found;* Weights of 12 tablets ranged from 422.5 to 447.0, average, 434.1, mgms. They contained 53.65% aspirin, or from 3.50 to 3.70, average, 3.59 grs.

Tablets deficient in aspirin.

11567. *Aspirin Tablets*, made by National Drug Co.; stock of Dr. S. H. Holmes, Jewett City. *Claimed per tablet;* 5 grs. *Found;* Weights of 12 tablets ranged from 339.0 to 356.0, average 347.1, mgms. They contained 84.90% aspirin, or from 4.44 to 4.66, average, 4.55 grs.

Tablets passed.

11563. *Aspirin Compound*, made by the P. F. Noyes Co.; stock of Dr. F. M. Dunn, New London. *Claimed per tablet;* Aspirin 1¼ grs., strontium salicylate 2 grs., acetphenetidin 1 gr., caffein ¼ gr., colchicin 1-200 gr., oil of wintergreen, q.s. *Found;* Weights of 20 tablets ranged from 368.5 to 400.5, average, 385.0, mgms. They contained 18.54 aspirin, 30.78 strontium salicylate, 14.10 acetphenetidin and 3.80 per cent. caffein; oil of wintergreen present and an alkaloid but insufficient for identification as colchicin.

One tablet contained in part

	Aspirin. grs.	Strontium salicylate. grs.	Acetphenetidin. gr.	Caffein. gr.
Heaviest	1.15	1.90	0.87	0.235
Lightest	1.05	1.75	0.80	0.216
Average	1.10	1.83	0.84	0.226

Tablets slightly deficient in aspirin, strontium salicylate and acetphenetidin.

Blaud's Compound.

11572. *Blaud Pills Compound No.* 6, made by Independent Pharmaceutical Co.; stock of Dr. E. P. Douglass, Groton. *Claimed*

per pill; Arsenious acid 1/60 gr., strychnin sulphate 1/60 gr., corrosive sublimate 1/60 gr., powdered capsicum 1/64 gr. extr. gentian 1/16 gr., Blaud's mass 5 grs. *Found;* Weights of 24 pills ranged from 577.8 to 646.2, average, 613.3, mgms. They contained 15.45 ferrous carbonate and 0.16 per cent. arsenious acid; capsicum and strychnin sulphate (impure residue=0.19%) present; mercury present but material insufficient for determination.

One pill contained in part

	Ferrous carbonate. grs.	Arsenious acid. gr.	Strychnin sulphate (impure). gr.
Heaviest	1.54	0.0160	0.0189
Lightest	1.38	0.0143	0.0169
Average	1.46	0.0151	0.0180

Tablets passed.

11593. *Blaud's Compound Tablets No. 7*, made by National Drug Co.; stock of Dr. F. Schavoir, Stamford. *Claimed per tablet;* Extr. nux vomica 1/10 gr., Blaud's mass 5 grs., arsenious acid 1/60 gr., extr. cascara sagrada 1 gr., manganese binoxid 1 gr. *Found;* Weights of 24 tablets ranged from 680.1 to 725.5, average, 703.5, mgms. They contained 8.30 ferrous carbonate, 0.15 arsenious acid, and 8.73 per cent. manganese binoxid; cascara and strychnin present (impure alkaloidal residue=0.20%).

One tablet contained in part

	Ferrous carbonate. gr.	Arsenious acid. gr.	Maganese binoxid. gr.
Heaviest	0.93	0.0168	0.98
Lightest	0.87	0.0157	0.92
Average	0.90	0.0163	0.95

Tablets satisfactory.

Bronchitis Tablets.

11585. *Bronchitis No. 6*, made by C. Killgore; stock of Dr. F. E. Wilcox, Willimantic. *Claimed per tablet;* Creosote 1 min., strychnin sulphate 1/60 gr., terpen hydrate 2 grs., eucalyptol ½ gr. *Found;* Weights of 20 tablets ranged from 461.2 to 535.4, average, 499.6 mgms. They contained 0.23 strychnin sulphate and approximately 22.60 per cent. terphen hydrate; creosote and possibly eucalyptol present.

One tablet contained in part:

	Strychnin Sulphate. gr.	Terpen hydrate (approx.) grs.
Heaviest	0.0190	1.87
Lightest	0.0164	1.61
Average	0.0177	1.74

Tablets probably slightly deficient in terpen hydrate.

Calcreose.

11552. *Calcreose No. 2*, made by the Maltbie Chemical Co.; stock of Dr. C. K. Heady, Milford. *Claimed per tablet;* Calcreose (a powder containing approximately 5% of beechwood creosote in chemical combination with calcium) 4 grs., reduced iron ½ gr., arsenic trioxid 1/150 gr., strychnin 1/150 gr. *Found;* Weights of 20 tablets ranged from 570.0 to 621.4, average, 590.9 mgms. They contained calcium oxid 8.92, reduced iron 6.33, arsenic trioxid 0.038, ash 29.91, talc 3.14, strychnin not over 0.035 and creosote approximately 15.38 per cent.

The amounts of arsenic and strychnin are much higher than claimed.

Calomel Tablets.

11575. *Calomel Tablet Triturates*, made by Buffington Pharmacy Co.; stock of Dr. R. E. Black, New London. *Claimed per tablet;* Calomel 1/10 gr., flavored with wintergreen. *Found;* Weights of 26 tablets ranged from 70.7 to 86.2, average, 77.1, mgms. They contained 8.10 per cent. of calomel, or from 0.089 to 0.109, average 0.097 gr.

Tablets satisfactory.

11573. *Calomel Tablets*, made by Drug Products Co.; stock of Dr. W. A. Hillard, Pawcatuck. *Claimed per tablet;* Calomel 1/10 gr., flavored with spearmint. *Found;* Weights of 25 tablets ranged from 72.7 to 89.4, average, 76.7 mgms. They contained 8.42 per cent. of calomel, or from 0.094 to 0.116, average, 0.099 gr.

Tablets satisfactory.

11627. *Calomel Tablet Triturates*, made by the Harvey Co.; stock of Dr. G. F. Lewis, Stratford. *Claimed per tablet;* Calomel 1 gr. *Found;* Weights of 25 tablets ranged from 111.5 to 126.8, average, 119.9 mgms. They contained 49.37 per cent. of calomel, or from 0.85 to 0.97, average, 0.91 gr.

Tablets passed.

11611. *Calomel Tablets* (*Calomets*), made by Moore and Co.;

stock of Dr. E. M. Hamblin, Bristol. *Claimed per tablet;* Calomel 1/10 gr. *Found;* Weights of 25 tablets ranged from 28.2 to 38.4, average, 36.2 mgms. They contained 16.85 per cent. of calomel, or from 0.068 (a single light tablet) to 0.109, average, 0.094 gr.

Tablets satisfactory.

11568. *Calomel Tablet Triturates,* made by National Drug Co.; stock of Dr. S. H. Holmes, Jewett City. *Claimed per tablet;* Calomel 1/10 gr. *Found;* Weights of 25 tablets ranged from 73.6 to 87.2, average, 79.3 mgms. They contained 7.94 per cent. of calomel, or from 0.091 to 0.107, average, 0.097 gr.

Tablets satisfactory.

11559. *Calomel Tablet Triturates,* made by E. L. Patch Co.; stock of Dr. H. Stendel, Ansonia. *Claimed per tablet;* Calomel, 1 gr. *Found;* Weights of 25 tablets ranged from 134.2 to 148.8, average, 141.2 mgms. They contained 45.28 per cent. of calomel, or from 0.94 to 1.04, average, 0.99 gr.

Tablets satisfactory.

11609. *Calomel Tablets,* made by Tailby-Nason Co.; stock of Dr. W. R. Hanrahan, Bristol. *Claimed per tablet;* Calomel 2 grs. *Found;* Weights of 18 tablets ranged from 153.2 to 169.5, average, 161.7 mgms. Tablets contained 69.34 per cent. of calomel, or from 1.64 to 1.82, average, 1.73 grs.

Tablets deficient in calomel.

11586. *Calomel Tablets,* stock of Dr. T. R. Parker, Willimantic; **11603,** stock of Dr. C. A. Hamilton, Waterbury; **11557,** stock of Dr. T. J. Connors, West Haven; all made by Yates Drug and Chemical Co. *Claimed per tablet;* Calomel 1/10 gr. *Found;* In **11586** weights of 25 tablets ranged from 84.5 to 98.5, average, 94.9 mgms. They contained 6.62 per cent. of calomel, or from 0.086 to 0.101, average, 0.097 gr. In **11603** weights of 25 tablets ranged from 90.1 to 110.9, average, 106.3 mgms. They contained 6.30 per cent. of calomel, or from 0.088 to 0.108, average, 0.103 gr. In **11557** weights of 25 tablets ranged from 90.0 to 99.6, average, 95.8 mgms. They contained 7.04 per cent. of calomel, or from 0.098 to 0.108, average, 0.104 gr.

Tablets in the three samples satisfactory.

11595. *Calomel Tablets,* stock of Dr. W. Burke, Greenwich; **11614,** stock of Dr. N. A. Burr, Manchester; both made by Yates Drug and Chemical Co. *Claimed per tablet;* Calomel 1/4 gr.

Found; In **11595** weights of 25 tablets ranged from 90.1 to 100.9, average, 96.8 mgms. They contained 16.23 per cent. of calomel or from 0.226 to 0.253, average, 0.242 gr. In **11614** weights of 25 tablets ranged from 86.2 to 95.5, average, 91.1 mgms. They contained 17.16 per cent. of calomel, or from 0.228 to 0.252, average, 0.242 gr.

Tablets in both samples satisfactory.

Calomel and Soda Tablets.

11571. *Calomel and Soda Tablet Triturates No.* 3, made by Independent Pharmaceutical Co.; stock of Dr. E. P. Douglass, Groton. *Claimed per tablet;* Calomel 1/4 gr., sodium bicarbonate 1 gr. *Found;* Weights of 25 tablets ranged from 116.5 to 130.2, average, 124.3 mgms. They contained 12.52 calomel and 57.46 per cent. sodium bicarbonate, so that one tablet contained:

	Calomel. gr.	Sodium bicarbonate. grs.
Heaviest	0.252	1.15
Lightest	0.225	1.03
Average	0.240	1.10

Tablets are satisfactory.

11570. *Calomel Compound Tablet Triurates No.* 6, made by E. L. Patch Co.; stock of Dr. J. H. McLoughlin, Jewett City. *Claimed per tablet;* Calomel 1/2 gr., sodium bicarbonate 1/2 gr. *Found;* Weights of 25 tablets ranged from 150.0 to 166.9, average, 160.3 mgms. They contained 19.74 calomel and 74.93 per cent. sodium bicarbonate, so that one tablet contained:

	Calomel gr.	Sodium bicarbonate. grs.
Heaviest	0.509	1.93
Lightest	0.456	1.73
Average	0.488	1.85

Tablets satisfactory, the claim for sodium bicarbonate probably having been copied incorrectly.

11606. *Calomel and Soda Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. J. Gaucher, Waterbury. *Claimed per tablet;* Calomel 1/10 gr., sodium bicarbonate 1 gr. *Found;* Weights of 25 tablets ranged from 121.9 to 129.6, average, 126.5 mgms. They contained 5.34 calomel and 51.14 per cent. sodium bicarbonate, so that one tablet contained:

	Calomel. gr.	Sodium bicarbonate. grs.
Heaviest	0.107	1.02
Lightest	0.100	0.96
Average	0.104	1.00

Tablets satisfactory.

Cascara Compound.

11607. *Cascara Compound No. 3*, made by E. L. Patch Co.; stock of Dr. R. J. Lawton, Terryville. *Claimed per tablet;* Cascarin ¼ gr., aloin ¼ gr., podophyllin 1/6 gr. extr. belladonna ⅛ gr., strychnin sulphate 1/60 gr., gingerine ⅛ gr. *Found;* Weights of 25 tablets ranged from 165.9 to 199.6, average, 181.5 mgms. They contained aloin, ginger, resins (probably podophyllin) and probably cascara; no tests were made for belladonna alkaloids; no calomel present; 0.56 per cent. of total alkaloids chiefly strychnin. Heaviest tablet contained 0.0172, lightest 0.0143, average 0.0157 gr. of strychnin.

Tablets satisfactory.

Cathartic Compound.

11578. *Cathartic Compound*, made by Daggett and Miller Co.; stock of Dr. J. N. Callahan, Norwich. *Claimed per tablet;* Extr. colocynth Co. 1¼ grs., calomel 1 gr., jalap resin 1/3 gr., powdered gamboge ¼ gr. *Found;* Weights of 17 tablets ranged from 410.2 to 443.9, average, 430.3 mgms. They contained 14.60 per cent. of calomel, a large amount of resinous material, aloes and a bitter principle (colocynth), the aloes indicating the presence of Extr. colocynth Co. The tablets contained from 0.92 to 1.00, average, 0.97 gr. of calomel.

Tablets satisfactory.

11452. *Cathartic Compound*, made by National Drug Co.; stock of Dr. T. Martino, Hartford. *Claimed per tablet;* Extr. colocynth Co., 1¼ grs., calomel 1 gr., jalap resin 1/8 gr., powdered gamboge ¼ gr. *Found;* Weights of 20 tablets ranged from 320.0 to 346.1, average, 332.0 mgms. They contained 14.60 per cent. of calomel, a large amount of resinous material, aloes and a bitter principle (colocynth), the aloes indicating the presence of Extr. colocynth Co. The tablets contained from 0.72 to 0.78, average, 0.75 gr. of calomel.

Tablets deficient in calomel.

Cold Tablets.

11576. *Cold Tablets*, made by Buffington Pharmacy Co.; stock of Dr. R. E. Black, New London. *Claimed per tablet;* Acetanilid 1½ grs., powdered opium 3/20 grs., camphor monobrom 1/3 gr., caffein citrated ½ gr., cascara sagrada ½ gr. *Found;* Weights of 20 tablets ranged from 252.8 to 269.6, average, 263.1 mgms. They contained 33.40 acetanilid and 12.16 per cent. of caffein citrated U. S. P.; powdered opium, camphor monobrom and cascara present. One tablet contained in part:

	Acetanilid. grs.	Caffein citrated, U. S. P. gr.
Heaviest	1.39	0.51
Lightest	1.30	0.47
Average	1.36	0.49

Tablets deficient in acetanilid.

11618. *Cold Tablets No. 2 (Dr. Gage)* made by Moore and Co.; stock of Dr. T. E. O'Loughlin, Rockville. *Claimed per tablet;* Powdered capsicum ¼ gr., tinct. aconite 1 min., quinin sulphate 2 grs. and Dover's powder 2 grs. *Found;* Weights of 20 tablets ranged from 415.4 to 462.2, average, 446.4 mgms. They contained 28.77 per cent. quinin sulphate; capsicum, Dover's powder (opium and ipecac) present; no test made for aconitin. They contained from 1.84 to 2.05, average, 1.98 grs. quinin sulphate.

Tablets satisfactory so far as tested.

Hammond's Tonic.

11560. *Triturate Tablets Tonic (Dr. Hammond)*, made by E. L. Patch Co.; stock of Dr. H. Stendel, Ansonia. *Claimed per tablet;* Iron pyrophosphate ½ gr., quinin sulphate ½ gr., strychnin sulphate 1/120 gr. *Found;* Weights of 20 tablets ranged from 95.8 to 100.8, average, 98.9 mgms. They contained 23.90 total alkaloids, 6.12 iron and 11.24 per cent. phosphoric acid; quinin and strychnin present as sulphates; material insufficient for quantitative separation of the small amount of strychnin. Iron pyrophosphate is an indefinite salt, but judging from the relation between the iron and phosphoric acid found, the tablets contained from 19 to 20 per cent. of anhydrous iron pyrophosphate.

Tablets passed as probably satisfactory.

Headache Tablets.

11608. *Acetanilid Comp. Tablets*, made by Brewer and Co.; stock of Dr. W. R. Hanrahan, Bristol. *Claimed per tablet;* Acetan-

ilid 3.5 grs., caffeine 0.5 grs., sodium bicarbonate 1 gr. *Found;* Weights of 15 tablets ranged from 452.7 to 477.8, average, 462.3 mgms. They contained 47.52 acetanilid, 6.80 caffeine and 13.94 per cent. sodium bicarbonate, so that one tablet contained:

	Acetanilid. grs.	Caffein. gr.	Sodium bicarbonate. grs.
Heaviest.....	3.50	0.50	1.03
Lightest.....	3.32	0.48	0.97
Average.....	3.39	0.49	0.99

Tablets satisfactory

11626. *Acetanilid Comp. Tablets, No.* 4, made by National Drug Co.; stock of Dr. E. J. Thompson, Hartford. *Claimed per tablet;* Acetanilid 3½ grs., sodium bicarbonate 8/10 gr., sodium bromid 1/10 gr., caffeine citrated ½ gr. *Found;* Weights of 15 tablets ranged from 375.9 to 403.9, average, 389.2 mgms. They contained 57.93 acetanilid, 15.46 sodium bicarbonate, 1.46 sodium bromid and 8.24 per cent. citrated caffeine U. S. P., so that one tablet contained:

	Acetanilid. grs.	Sodium bicarbonate. gr.	Sodium bromid. gr.	Caffein citrated, U. S. P. gr.
Heaviest.....	3.61	0.96	0.091	0.51
Lightest.....	3.36	0.90	0.085	0.48
Average.....	3.48	0.93	0.088	0.50

Tablets passed, although slightly deficient in sodium bromid.

11444. *Acetanilid Comp. Tablets No.* 17, made by National Drug Co.; stock of Dr. C. L. Dichter, Stamford. *Claimed per tablet;* Acetanilid 3 grs., sodium bicarbonate 2 grs., caffeine citrated ½ gr., camphor monobrom ½ gr., acid tartaric 1/8 gr., fl. ex. gelsemium 1 min., oil of cinnamon q. s. *Found;* Weights of 12 tablets ranged from 438.5 to 459.8, average, 446.1 mgms. They contained 43.16 acetanilid, 7.20 citrated caffein U. S. P., and 28.45 per cent. sodium bicarbonate; camphor monobrom, tartaric acid, oil of cinnamon and gelsemium present, so that one tablet contained in part:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.	Sodium bicarbonate. grs.
Heaviest.....	3.06	0.51	2.02
Lightest.....	2.92	0.49	1.93
Average.....	2.97	0.50	1.96

Tablets satisfactory.

11622. *Migrain Tablets No. 2*, made by E. L. Patch Co.; stock of Dr. T. F. Rockwell, Rockville. *Claimed per tablet;* Acetanilid 2 grs., caffein citrated 0.5 gr. camphor monobrom 0.5 gr. *Found;* Weights of 20 tablets ranged from 227.2 to 254.4, average, 240.3 mgms. They contained 54.26 acetanilid and 13.32 per cent. citrated caffein U. S. P. camphor monobron present; so that one tablet contained:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.
Heaviest	2.13	0.52
Lightest	1.90	0.47
Average	2.01	0.49

Tablets satisfactory.

11620. *Migrain Tablets No. 3*, made by Surgeons and Physicians Supply Co.; stock of Dr. T. F. O'Loughlin, Rockville. *Claimed per tablet;* Acetanilid 2 grs., caffein citrated 0.5 gr., camphor monobrom 0.5 gr. *Found;* Weights of 15 tablets ranged from 298.7 to 349.8, average, 328.8 mgms. They contained 36.20 acetanilid and 8.92 per cent. citrated caffein, U. S. P.; camphor monobrom present; so that one tablet contained:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.
Heaviest	1.95	0.48
Lightest	1.77	0.41
Average	1.84	0.45

Tablets passed.

11583. *Migrain Tablets*, made by Tailby-Nason Co.; stock of Dr. T. Soltz, New London. *Claimed per tablet;* Acetanilid 2 grs., caffein citrated 0.5 gr., camphor monobrom 0.5 gr. *Found;* Weights of 20 tablets ranged from 198.4 to 233.4, average, 223.0 mgms. They contained 58.03 acetanilid and 14.36 per cent. citrated caffein, U. S. P.; camphor monobrom present; so that one tablet contained:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.
Heaviest	2.09	0.52
Lightest	1.78	0.44
Average	2.00	0.50

Tablets satisfactory.

11601. *Migrain Tablets*, made by Tailby-Nason Co.; stock of Dr. C. Rowling, New Haven. *Claimed per tablet;* Acetanilid

2 grs., caffein 0.25 gr., camphor monobrom 0.5 gr. *Found;* Weights of 20 tablets ranged from 202.6 to 230.6, average, 221.2 mgms. They contained 57.94 acetanilid and 7.18 per cent. caffein; camphor monobrom present; so that one tablet contained:

	Acetanilid. grs.	Caffein. gr.
Heaviest	2.06	0.26
Lightest	1.81	0.22
Average	1.98	0.24

Tablets satisfactory.

11605. *Headache Tablets* (Dr. F. J. Hawley), made by Yates Drug and Chemical Co.; stock of Dr. J. Caucher, Waterbury. *Claimed per tablet;* Acetanilid 2.5 grs., aromatic powder 0.5 gr., sodium bicarbonate 1 gr., caffein 0.5 gr., camphor 0.1 gr., oil quassia q. s. *Found;* Weights of 15 tablets ranged from 341.6 to 362.7, average, 330.6 mgms. They contained 46.61 acetanilid, 8.90 caffein and 19.16 per cent. sodium bicarbonate; volatile oil, aromatics and camphor present; so that one tablet contained:

	Acetanilid. grs.	Caffein. gr.	Sodium bicarbonate. grs.
Heaviest	2.61	0.50	1.07
Lightest	2.46	0.47	1.01
Average	2.52	0.48	1.04

Tablets satisfactory.

Hexamethylene Tetramine Tablets.

11598. *Hex-uro-gen,* made by Daggett and Miller Co.; stock of Dr. H. L. F. Locke, Hartford. *Claimed per tablet;* Hexamethylenamine 5 grs., acid sodium phosphate 5 grs. *Found;* Weights of 12 tablets ranged from 676.9 to 706.7, average, 694.7 mgms. They contained 51.80 hexamethylene tetramine and 42.16 per cent. of acid sodium phosphate, so that one tablet contained:

	Hexamethylene tetramine. grs.	Acid sodium phosphate. grs.
Heaviest	5.65	4.60
Lightest	5.41	4.41
Average	5.55	4.52

Tablets satisfactory.

11612. *Hexaform Tablets,* made by Yates Drug and Chemical Co.; stock of Dr. A. S. Brackett, Bristol. *Claimed per tablet;* Hexaform 5 grs. *Found;* Weights of 12 tablets ranged from 311.8

to 338.2, average, 323.6 mgms. They contained 99.75 per cent. hexamethylene tetramine, or from 4.80 to 5.21, average, 4.98 grs. per tablet.

Tablets satisfactory.

Hypophosphites Compound.

11599. *Tabs. Hypophosphites Compound Improved*, made by Daggett and Miller Co.; stock of Dr. H. L. F. Locke, Hartford. *Claimed per tablet;* Iron hypophosphite 3/8 gr., manganese hypophosphite ¼ gr., quinin hypophosphite 1/6 gr., calcium hypophosphite ¼ gr., potassium hypophosphite 3/8 gr., strychnin hypophosphite 1/64 gr., arsenious acid 1/50 gr., cascarin 1/8 gr. *Found;* Weights of 25 tablets ranged from 150.2 to 177.9, average, 161.4 mgms. They contained 2.05 iron, 2.42 manganese, 1.04 calcium, 3.57 potassium, 10.82 phosphorus and 0.51 per cent. arsenious acid; quinin, strychnin and hypophosphites present. The claimed amounts of the various hypophosphites require 3.31 per cent. iron, 2.95 manganese, 2.34 calcium and 5.59 potassium, with 17.37 total phosphorus. Our analysis shows only about 62 per cent. of the required phosphorus and deficiencies in iron, manganese, calcium and potassium.

Tablets below strength claimed.

Iodized Calcium.

11449. *Calcium Iodized*, made by Daggett and Miller Co.; stock of Dr. S. M. Garlick, Bridgeport. *Claimed per tablet;* Calcium iodized 1 gr. *Found;* Weights of 25 tablets ranged from 91.5 to 111.0, average, 101.7 mgms. They contained 3.09 per cent. total iodin, 0.26 available iodin, 14.20 total calcium oxid and 3.28 calcium iodid (calculated from the non-available iodin). The tablets, therefore, contained from 1/227 to 1/270, average, 1/244 gr. available iodin and from 1/18 to 1/22, average, 1/20 gr. calcium iodid.

No standard for comparison.

La Grippe Saratoga Tablets.

11624. *La Grippe Saratoga Tablets*, made by the Harvey Co.; stock of Dr. J. B. Waters, Hartford. *Claimed per tablet;* Acetanilid 1¾ grs., caffein citrated ½ gr., ipecac, 1/20 gr., quinin salicylate ½ gr., capsicum 1/10 gr., podophyllin 1/40 gr., aloin 1/40 gr. *Found;* Weights of 15 tablets ranged from 350.2 to 405.9, average,

380.4 mgms. They contained 31.11 acetanilid, 8.96 citrated caffein U. S. P., 6.32 total alkaloids and 2.45 per cent. salicylic acid (probably as quinin salt); capsicum, quinin salicylate, aloin, podophyllin and ipecac powder present; so that one tablet contained in part:

	Acetanilid. grs.	Citrated Caffein, U. S. P. gr.
Heaviest.....	1.95	0.56
Lightest.....	1.68	0.48
Average.....	1.83	0.53

Tablets quite variable in weight, but satisfactory as regards average composition.

Mercury Protoiodid Tablets.

11602. *Mercury Protoiodid Tablets*, made by Polk Calder Co.; stock of Dr. M. D. Slattery, New Haven. *Claimed per tablet;* Mercury protoiodid ¼ gr., charcoal 1/10 gr., aromatics q.s. *Found;* Weights of 25 tablets ranged from 97.0 to 102.5, average, 99.1, mgms. They contained 15.22 per cent. of mercury protoiodid, or from 0.228 to 0.240, average, 0.233 gr. per tablet.

Tablets satisfactory.

Mixed Treatment.

11453. *Mixed Treatment* (*Dr. Sherwell*), made by National Drug Co.; stock of Dr. T. Martino, Hartford. *Claimed per tablet;* Corrosive sublimate 1/64 gr., potassium iodid 2 grs. syr. iron iodid 5 min., liq. arsenic and mercury iodid 2 min., tinct. nux vomica 3 min. *Found;* Weights of 20 tablets ranged from 497.4 to 532.4, average, 514.6, mgms. They contained 5.75 potassium and 20.06 per cent. iodin; mercury, arsenic and iron present; insufficient sample to confirm presence of nux vomica. Based on the potassium percentage tablets contained 24.41 per cent. potassium iodid, so that heaviest contained 2.01, lightest 1.87, average, 1.94 grs.

Tablets passed.

Myalgie (*Dr. Harvey*).

11566. *Myalgie* (*Dr. Harvey*), made by Daggett and Miller Co.; stock of Dr. G. E. Bradford, New London. *Claimed per tablet;* Sodium salicylate 2 grs., acetanilid 2 grs., cerium oxalate ½ gr., caffein citrated ½ gr. *Found;* Weights of 20 tablets ranged from 382.2 to 419.4, average, 406.6, mgms. They contained

21.26 sodium salicylate, 25.30 acetanilid, 4.92 citrated caffein U. S. P., and 7.10 per cent. cerium oxalate; so that one tablet contained

	Sodium Salicylate. grs.	Acetanilid. grs.	Citrated caffein, U. S. P. gr.	Cerium Oxalate. gr.
Heaviest	1.38	1.64	0.32	0.46
Lightest	1.26	1.50	0.29	0.42
Average	1.33	1.59	0.31	0.45

Tablets deficient in sodium salicylate, acetanilid and citrated caffein.

Neuralgie No. 5.

11610. *Neuralgie No. 5*, made by Yates Drug and Chemical Co.; stock of Dr. E. M. Hamblin Bristol. *Claimed per tablet;* Acetanilid 2 grs., aconitin 1/100 gr., strychnin muriate 1/120 gr., quinin muriate 1 gr. *Found;* Weights of 15 tablets ranged from 309.5 to 324.2, average, 317.9, mgms. They contained 39.60 acetanilid and 17.50 per cent. total alkaloids; quinin, strychnin and chlorids present; no test made for aconitin.

One tablet contained in part

	Acetanilid. grs.	Total Alkaloids. gr.
Heaviest	1.98	0.875
Lightest	1.89	0.837
Average	1.94	0.659

Tablets passed.

Phenolphthalein Tablets.

11581. *Phenolphthalein Tablets*, stock of Dr. N. B. Lewis, Norwich; **11589,** stock of Dr. G. A. Shelton, Shelton; both made by the G. F. Harvey Co. *Claimed per tablet;* Phenolphthalein 2 grs. *Found;* In **11581** weights of 24 tablets ranged from 276.9 to 303.9, average, 287.2, mgms. They contained 48.46 per cent. phenolphthalein, or from 2.07 to 2.27, average, 2.15, grs. per tablet. In **11589** weights of 20 tablets ranged from 288.7 to 305.2, average, 297.3 mgms. They contained 43.13 per cent. phenolphthalein, or from 1.92 to 2.03, average, 1.98 grs. per tablet.

Tablets in both samples satisfactory.

Phenolphthalein and Calomel Tablets.

11621. *Phenolphthalein and Calomel Tablets*, made by Tailby-Nason Co.; stock of Dr. T. F. Rockwell, Rockville. *Claimed per*

tablet; Phenolphthalein 1/10 gr., calomel 1/10 gr. *Found;* Weights of 25 tablets ranged from 90.9 to 109.2, average, 102.5, mgms. They contained 6.94 per cent. phenolphthalein and 6.56 calomel, so that one tablet contained

	Phenol-phthalein. gr.	Calomel. gr.
Heaviest	0.117	0.111
Lightest	0.097	0.092
Average	0.110	0.104

Tablets satisfactory.

Quinin Sulphate Tablets.

11615. *Quinin Sulphate Tablets*, made by Tailby-Nason Co.; stock of Dr. W. S. Gillam, South Manchester. *Claimed per tablet;* Quinin sulphate 2 grs. *Found;* Weights of 15 tablets ranged from 312.0 to 336.9, average, 322.6 mgms. They contained 38.41 per cent. quinin sulphate, or from 1.85 to 2.00, average, 1.91, grs. per tablet.

Tablets satisfactory.

11623. *Quinin Sulphate Tablets*, made by John Wyeth and Bro.; stock of Dr. J. B. Waters, Hartford. *Claimed per tablet;* Quinin sulphate 2 grs. *Found;* Weights of 20 tablets ranged from 256.6 to 280.0, average, 266.3, mgms. They contained 44.06 per cent. quinin sulphate, or from 1.74 to 1.90, average, 1.81 grs. per tablet.

Tablets deficient in quinin sulphate.

11590. *Quinin Sulphate Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. G. A. Shelton, Shelton. *Claimed per tablet;* Quinin sulphate 2 grs. *Found;* Weights of 20 tablets ranged from 210.0 to 234.5, average 225.3 mgms. They contained 62.18 per cent. quinin sulphate, or from 2.01 to 2.25, average, 2.16 grs. per tablet.

Tablets satisfactory.

Quinin and Nux Vomica Tablets.

11600. *Quinin and Nux Vomica Tablets*, made by Tailby-Nason Co.; stock of Dr. C. Rawling, New Haven. *Claimed per tablet;* Quinin sulphate 1 gr., extr. nux vomica 1/10 gr. *Found;* Weights of 20 tablets ranged from 175.9 to 195.3, average, 186.1 mgms. They contained 32.79 per cent. quinin sulphate; nux vomica

alkaloids present but not determined. Tablets contained in part from 0.89 to 0.99, average, 0.94 gr. quinin sulphate per tablet.

Tablets satisfactory.

Sodium Bromid Tablets.

11574. *Sodium Bromid Tablets*, made by Buffington Pharmacy Co.; stock of Dr. E. A. Hillard, Pawcatuck. *Claimed per tablet;* Sodium bromid 5 grs. *Found;* Weights of 25 tablets ranged from 317.0 to 328.2, average, 324.2 mgms. They consisted wholly of sodium bromid and contained from 4.89 to 5.06, average, 5.00 grs. per tablet.

Tablets satisfactory.

Sodium Salicylate Tablets.

11450. *Sodium Salicylate Tablets*, made by Drug Products Co.; stock of Dr. C. P. Townsend, Bridgeport. *Claimed per tablet;* Sodium salicylate 5 grs. *Found;* Weights of 12 tablets ranged from 376.5 to 465.0, average, 412.6, mgms. They contained 71.55 per cent. sodium salicylate, or from 4.16 to 5.14, average, 4.56 grs. per tablet.

Tablets deficient in sodium salicylate, 5 of the 12 showing a deficiency greater than 10 per cent. and only one containing the full amount claimed; very variable in weight.

11569. *Sodium Salicylate Tablets*, made by the Maltbie Chemical Co.; stock of Dr. J. H. McLoughlin, Jewett City. *Claimed per tablet;* Sodium salicylate 5 grs. *Found;* Weights of 20 tablets ranged from 428.5 to 464.5, average, 451.0 mgms. They contained 70.71 per cent. sodium salicylate, or from 4.67 to 5.07, average, 4.92 grs. per tablet.

Tablets satisfactory.

11613. *Sodium Salicylate Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. A. S. Brackett, Bristol. *Claimed per tablet;* Sodium salicylate 5 grs. *Found;* Weights of 21 tablets ranged from 425.0 to 450.5, average, 440.9, mgms. They contained 69.74 per cent. sodium salicylate, or from 4.57 to 4.85, average, 4.74 grs. per tablet.

Tablets passed.

Strontium Salicylate Tablets.

11580. *Strontium Salicylate Tablets*, made by Drug Products Co.; stock of Dr. N. B. Lewis, Norwich. *Claimed per tablet;*

Strontium salicylate, 5 grs. *Found;* Weights of 24 tablets ranged from 363.0 to 407.5, average, 386.5 mgms. They contained salicylic acid equivalent to 76.23 per cent. strontium salicylate (strontium present, but only 93.8 per cent. of theoretical amount), or from 4.27 to 4.80, average, 4.54 grs. per tablet.

Tablets deficient in strontium salicylate, 7 of the 24 showing a deficiency greater than 10 per cent., and no tablet containing the full amount claimed.

Strychnin Sulphate Tablets.

11564. *Strychnin Sulphate Tablets*, made by Bristol Myers Co.; stock of Dr. F. M. Dunn, New London. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* Weights of 53 tablets ranged from 66.0 to 86.2, average, 75.2 mgms. They contained 1.31 per cent. strychnin sulphate, or from 0.0134 to 0.0174, average, 0.0152 gr. per tablet.

Tablets satisfactory.

11440. *Strychnin Sulphate Tablets*, made by Independent Pharmaceutical Co.; stock of Dr. C. K. Isham, Hartford. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* Weights of 50 tablets ranged from 87.8 to 114.0, average, 96.0 mgms. They contained 1.09 per cent. strychnin sulphate, or from 0.0147 to 0.0192, average, 0.0161 gr. per tablet.

Tablets satisfactory.

11597. *Strychnin Sulphate Tablets*, made by Progressive Chemical Co., New Haven; stock of Dr. A. E. Abrams, Hartford. *Claimed per tablet;* Strychnin sulphate 1/50 gr. *Found;* Weights of 50 tablets ranged from 48.5 to 77.8, average, 67.6 mgms. They contained 0.79 per cent. strychnin sulphate, or from 0.0059 to 0.0095, average, 0.0082, gr. per tablet.

Tablets deficient in strychnin sulphate and very variable in weight.

11582. *Strychnin Sulphate Tablets*, made by the Tracy Co., New London; stock of Dr. T. Soltz, New London. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* Weights of 48 tablets ranged from 96.1 to 123.2, average, 109.3 mgms. They contained 0.91 per cent. strychnin sulphate, or from 0.0135 to 0.0173, average, 0.0154 gr. per tablet.

Tablets satisfactory.

11594. *Strychnin Sulphate Tablets*, stock of Dr. W. Burke, Greenwich; **11604,** stock of Dr. C. A. Hamilton, Waterbury; both made by Yates Drug and Chemical Co. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* In **11594** weights of 50 tablets ranged from 90.9 to 106.0, average, 99.0 mgms. They contained 1.03 per cent. strychnin sulphate, or from 0.0144 to 0.0169, average, 0.0158 gr. per tablet.

In **11604** weights of 51 tablets ranged from 94.0 to 101.0, average, 96.3 mgms. They contained 1.03 per cent. strychnin sulphate, or from 0.0149 to 0.0161, average, 0.0153 gr. per tablet.

Tablets in both samples satisfactory.

SOLUTIONS.

Elixir of Iron, Quinin and Strychnin.

11596. *Elixir of Iron, Quinin and Strychnin Phosphate*, made by Brewer and Co.; stock of Dr. A. E. Abrams, Hartford. *Claimed;* Each fl. dram contains tinct. iron citrochlorid 7½ min., quinin hydrochlorid ½ gr., strychnin phosphate 1/64 gr. *Found;* The elixir contained 16.68 per cent. alcohol by volume, 0.52 iron, 0.672 quinin (approximately) and 0.028 strychnin (approximately). It contained therefore, 8.8 min. tinct. iron citrochlorid, approximately 0.49 gr. quinin hydrochlorid and approximately 1/41 gr. strychnin phosphate.

Elixir satisfactory.

11616. *Elixir Iron, Quinin and Strychnin No. 2*, made by Yates Drug and Chemical Co.; stock of Dr. W. R. Tinker, South Manchester. *Claimed;* Each fl. oz. contains strychnin sulphate 2/15 gr., quinin sulphate 4 grs., tinct. iron citrochlorid 60 min., sodium citrate q.s., alcohol 19 per cent. *Found;* The elixir contained 17.55 per cent. alcohol by volume, 0.52 iron, 0.577 quinin (approximately), and 0.020 strychnin (approximately). It therefore contained per fl. oz. 70.9 min. tinct. iron citrochlorid, approximately 3.85 grs., quinin sulphate and approximately 2/15 gr. strychnin sulphate.

Elixir satisfactory.

Elixir Lactated Pepsin.

11617. *Elixir Lactated Pepsin Stronger*, made by the Harvey Co., stock of Dr. W. R. Tinker, South Manchester *Claimed;*

Each fl. dram contains pepsin (1/3000) 1 gr., pancreatin 1 gr., maltase ¼ gr., diastase 1/16 gr., lactic acid 5/32 min., hydrochloric acid ⅛ min., alcohol 17 per cent. *Found;* Spec. grav. @ 15.6° C. 1.1228, alcohol by volume 16.35 per cent.; pepsin and pancreatin present; diastatic action faint, if any. The pepsin present showed about 15.5 per cent. of the activity the claimed amount of U. S. P. pepsin should exhibit, the pancreatin from 8 to 10 per cent. of the claimed activity.

Elixir below the strength claimed.

Solution Iodin and Potassium Iodid.

11591. *Sol. Iodin and Potassium Iodid,* made by Yates Drug and Chemical Co.; stock of Dr. J. E. Black, Shelton. *Claimed;* Alcohol 91.5; tinct. iodin 1 part, alcohol 2 parts. *Found;* It contained 91.70 per cent. alcohol by volume, and 1.69 gms. potassium iodid and 2.83 gms. iodin per 100 cc. A solution of one part of tincture iodin U. S. P. and two parts of alcohol should contain from 1.50 to 1.83 gms. potassium iodid and from 2.16 to 2.50 gms. iodin per 100 cc.

Solution satisfactory.

Spt. Ammonia Aromatic.

11561. *Spt. Ammonia Aromatic,* made by Yates Drug and Chemical Co.; stock of Dr. C. W. Gaylord, Branford. *Claimed;* Spirit of Ammonia Aromatic, alcohol 67 per cent. *Found;* Sample contained 62.00 per cent. alcohol by volume, and 1.6167 gms. of ammonia per 100 cc. with aromatic oils.

Solution passed.

Syrup Hydriodic Acid.

11562. *Syrup Hydroidic Acid,* made by Norwich Pharmacal Co.; stock of Dr. C. W. Gaylord, Branford. *Claimed;* Syr. hydriodic acid, U. S. P. *Found;* Spec. grav. @ 25° C. 1.2155 1.32 gms. hydriodic acid per 100 cc.

Solution passed.

TABLE XIX.—VARIATIONS IN THE WEIGHTS OF MEDICINAL TABLETS.

Station No.	Name of Tablet.	Weight per tablet.			Maximum variation.		
		Maximum. mgms.	Minimum. mgms.	Average. mgms.	Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Acetasol.						
11592	Daggett & Miller Co.	363.4	345.9	353.2	2.9	2.1	5.0
	Ammon. Salicylate Compound.						
11588	Daggett & Miller Co.	454.8	405.2	425.5	6.9	4.8	11.7
	Antiseptic (Corrosive Sublimate).						
11577	Daggett & Miller Co. (7 grs.)	666.2	569.8	603.4	10.4	5.6	16.0
11619	Direct Sales Co. (7.3 grs.)	1016.8	970.8	983.9	3.3	1.3	4.6
11558	The Tracy Co. (7.3 grs.)	1083.9	1061.9	1073.3	1.0	1.1	2.1
	Alkaline Antiseptic.						
11625	National Drug Co.	883.1	834.2	863.2	2.3	3.4	5.7
	Antiseptic Germicide.						
11447	Maltbie Chem. Co.	1152.6	1040.8	1096.1	5.2	5.0	10.2
	Arsenious Iodid Comp.						
11445	Drug Products Co.	559.5	497.2	534.6	4.5	7.0	11.5
	Aspirin.						
11587	Daggett & Miller Co. (5 grs.)	447.0	422.5	434.1	3.0	2.7	5.7
11567	National Drug Co. (5 grs.)	356.0	339.0	347.1	2.6	2.3	4.9
	Aspirin Compound.						
11563	P. J. Noyes Co.	400.5	368.5	385.0	3.0	4.3	7.3
	Blaud's Compound.						
11572	Independent Pharm. Co.	646.2	577.8	613.3	5.4	5.8	11.2
11593	National Drug Co.	725.5	680.1	703.5	3.1	3.3	6.4
	Bronchitis No. 6.						
11585	C. Killgore	535.4	461.2	499.6	7.2	7.7	14.9
	Calcrease.						
11552	Maltbie Chem. Co.	621.4	570.0	590.9	5.2	3.5	8.7
	Calomel.						
11575	Buffington Pharm. Co. (1/10 gr.)	86.2	70.7	77.1	11.8	8.3	20.1
11573	Drug Products Co. (1/10 gr.)	89.4	72.7	76.7	16.6	5.2	21.8
11627	Harvey Co. (1 gr.)	126.8	111.5	119.9	5.8	7.0	12.8
11611	Moore & Co. (1/10 gr.)	38.4	28.2	36.2	6.1	22.1	28.2
11568	National Drug Co. (1/10 gr.)	87.2	73.6	79.3	10.0	7.2	17.2
11559	E. L. Patch Co. (1 gr.)	148.8	134.2	141.2	5.4	5.0	10.8
11609	Tailby-Nason Co. (2 grs.)	169.5	153.2	161.7	4.8	5.3	10.1
11586	Yates Drug & Chem. Co. (1/10 gr.)	98.5	84.5	94.9	3.8	11.0	14.8
11603	" " " " (1/10 gr.)	110.9	90.1	106.3	4.3	15.2	19.5
11557	" " " " (1/10 gr.)	99.6	90.0	95.8	4.0	6.1	10.1
11595	" " " " (¼ gr.)	100.9	90.1	96.8	4.2	6.9	11.1
11614	" " " " (¼ gr.)	95.5	86.2	91.1	4.8	5.4	10.2
	Calomel & Soda.						
11571	Independent Pharm. Co. (¼ gr.)	130.2	116.5	124.3	4.7	6.3	11.0
11570	E. L. Patch Co. (½ gr.)	166.9	150.0	160.3	4.1	6.4	10.5
11606	Yates Drug & Chem. Co. (1/10 gr.)	129.6	121.9	126.5	2.5	3.6	6.1
	Cascara Compound.						
11607	E. L. Patch Co.	199.6	165.9	181.5	10.0	8.6	18.6
	Cathartic Compound.						
11578	Daggett & Miller Co.	443.9	410.2	430.3	3.2	4.7	7.9
11452	National Drug Co.	346.1	320.0	332.0	4.2	3.6	7.8

TABLE XIX.—VARIATIONS IN THE WEIGHTS OF MEDICINAL TABLETS—*Continued.*

Station No.	Name of Tablet.	Weight per tablet.			Maximum variation.		
		Maximum. mgms.	Minimum. mgms.	Average. mgms.	Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Cold Tablets.						
11576	Buffington Pharm. Co.	269.6	252.8	263.1	2.5	3.9	6.4
11618	Moore & Co.	462.2	415.4	446.4	3.5	7.0	10.5
	Hammond's Tonic.						
11560	E. L. Patch Co.	100.8	95.8	98.9	1.9	3.1	5.0
	Headache Tablets (Acetanilid).						
11608	Brewer & Co. (3.5 grs.)	477.8	452.7	462.3	3.4	2.1	5.5
11626	National Drug Co. (3.5 grs.)	403.9	375.9	389.2	3.9	3.4	7.3
11444	" " " (3 grs.)	459.8	438.5	446.1	3.4	1.7	4.8
11622	E. L. Patch Co. (2 grs.)	254.4	227.2	240.3	5.9	5.5	11.4
11620	Surg. & Phys. Supply Co. (2 grs.)	349.8	298.7	328.8	6.4	9.2	15.6
11583	Tailby-Nason Co. (2 grs.)	233.4	198.4	223.0	4.7	11.0	15.7
11601	" " " (2 grs.)	230.6	202.6	221.2	4.2	8.4	12.6
11605	Yates Drug & Chem. Co. (2.5 grs.).	362.7	341.6	350.6	3.2	2.6	5.8
	Hexamethylene tetramine.						
11598	Daggett & Miller Co. (5 grs.)	706.7	676.9	694.7	1.7	2.6	4.3
11612	Yates Drug & Chem. Co. (5 grs.)	338.2	311.8	323.6	4.5	3.6	8.1
	Hypophosphites Compound.						
11599	Daggett & Miller Co.	177.9	150.2	161.4	10.2	6.9	17.1
	Iodized Calcium.						
11449	Daggett & Miller Co. (1 gr.)	111.0	91.5	101.7	9.1	10.0	19.1
	LaGrippe Tablets.						
11624	Harvey Co.	405.9	350.2	380.4	6.7	7.9	14.6
	Mercury Protoiodid.						
11602	Polk Calder Co. (¼ gr.)	102.5	97.0	99.1	3.4	2.1	5.5
	Myalgie.						
11566	Daggett & Miller Co.	419.4	383.2	406.6	3.1	5.8	8.9
	Neuralgie.						
11610	Yates Drug & Chem. Co.	324.2	309.5	317.9	2.0	2.6	4.6
	Phenolphthalein.						
11581	G. F. Harvey Co. (2 grs.)	303.9	276.9	287.2	5.8	3.6	9.4
11589	" " " (2 grs.)	305.2	288.7	297.3	2.7	2.9	5.6
	Phenolphthalein & Calomel.						
11621	Tailby-Nason Co. (1/10 gr.)	109.2	90.9	102.5	6.5	11.3	17.8
	Quinin sulphate.						
11615	Tailby-Nason Co. (2 grs.)	336.9	312.0	322.6	4.4	3.3	7.7
11623	John Wyeth & Bro. (2 grs.)	280.0	256.5	266.3	5.1	3.7	8.8
11590	Yates Drug & Chem. Co. (grs. 2)	234.5	210.0	225.3	4.1	6.8	10.9
	Quinin & Nux vomica.						
11600	Tailby-Nason Co.	195.3	175.9	186.1	4.9	5.5	10.4
	Sodium bromid.						
11574	Buffington Pharm. Co. (5 grs.)	328.2	317.0	324.2	1.2	2.2	3.4
	Sodium salicylate.						
11450	Drug Products Co. (5 grs.)	465.0	376.5	412.6	12.7	8.7	21.4
11569	Maltbie Chem. Co. (5 grs.)	464.5	428.5	451.0	3.0	5.0	8.0
11613	Yates Chem. & Drug Co. (5 grs.)	450.5	425.0	440.9	2.2	3.6	5.8
	Strontium salicylate.						
11580	Drug Products Co. (5 grs.)	407.5	363.0	386.5	5.4	6.1	11.5

TABLE XIX.—VARIATIONS IN THE WEIGHTS OF MEDICINAL TABLETS—*Concluded.*

Station No.	Name of Tablet.	Weight per tablet.			Maximum variation.		
		Maximum. mgms.	Minimum. mgms.	Average. mgms.	Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Strychnin sulphate.						
11564	Bristol Myers Co. (1/60 gr.).....	86.2	66.0	75.2	14.6	12.2	26.8
11440	Independent Pharm. Co. (1/60 gr.)..	114.0	87.8	96.0	18.8	8.5	27.1
11597	Progerssive Chem. Co. (1/50 gr.)...	77.8	48.5	67.6	15.1	28.3	43.4
11582	The Tracy Co. (1/60 gr.).....	123.2	96.1	109.3	12.7	12.1	24.8
11594	Yates Drug & Chem. Co. (1/60 gr.)	106.0	90.9	99.0	7.1	8.2	15.3
11604	" " " " (1/60 gr.)	101.0	94.0	96.3	4.9	2.4	7.3

Summary.

Fifteen of the 76 samples did not contain the amounts of drugs claimed, allowing a tolerance of 10 per cent. The names of these with their manufacturers were as follows:

Buffington Pharm. Co.
  Cold Tablets.
Daggett and Miller Co.
  Acetasol.
  Ammonium Salicylate Comp.
  Antiseptic Tablets No. 2.
  Aspirin Tablets.
  Tabs. Hypophosphites Comp.
  Myalgie (Dr. Harvey).
Drug Products Co.
  Sodium Salicylate.
  Strontium Salicylate.
The Harvey Co.
  Elixir Lactated Pepsin.
National Drug Co.
  Cathartic Compound.
B. F. Noyes Co.
  Aspirin Compound.
Progessive Chemical Co.
  Strychnin Sulphate.
Tailby-Nason Co.
  Calomel Tablets.
John Wyeth and Bro.
  Quinin Sulphate.

Or to summarize the whole inspection, of 111 samples of tablets 22 were deficient, and of 18 samples of solutions 8 were unsatisfactory.

Variations in the Weights of Tablets.

This subject having been discussed at some length in our Report for 1916, only a summary of the results will be discussed here. We now have data on the variations in weight of 111 samples of tablets. While in some cases these are remarkably uniform in weight, in others the variations are so great as to indicate very careless manufacture. Table XIX gives the detailed results on this year's samples.

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS.

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Minimum. grs.	Average. grs.	Maximum Variation from Claim. Above.	Below.
						%	%
11588	Ammonium Salicylate Comp.						
	Ammonium salicylate.....	2	1.90	1.70	1.78	0	15.0
	Caffein.....	1	0.94	0.84	0.88	0	16.0
	Acetanilid.....	1⅛	1.35	1.21	1.26	1.5	9.0
11577	Antiseptic Tablets No. 2.						
	Corrosive sublimate.....	7	5.78	4.94	5.24	0	29.4
11619	Antiseptic Tablets No. 1.						
	Corrosive sublimate.....	7.3	7.41	7.08	7.17	1.1	3.0
11558	Antiseptic Tablets No. 1.						
	Corrosive sublimate.....	7.3	7.79	7.63	7.72	6.7	4.1
11447	Antiseptic Germicide.						
	Mercuric iodid.....	⅜	0.361	0.326	0.343	0	13.1
	Potassium iodid.....	⅜	0.512	0.463	0.487	36.5	0
	Sodium bicarbonate.....	6	16.88	15.14	15.94		
11445	Arsenious Iodid Compound.						
	Potassium iodid.....	2	1.91	1.70	1.82	0	15.0
11587	Aspirin.						
	Aspirin.....	5	3.70	3.50	3.59	0	30.0
11567	Aspirin.						
	Aspirin.....	5	4.66	4.44	4.55	0	11.2
11563	Aspirin Compound.						
	Aspirin.....	1¼	1.15	1.05	1.10	0	16.0
	Strontium salicylate.....	2	1.90	1.75	1.83	0	12.5
	Acetphenetidin.....	1	0.87	0.80	0.84	0	20.0
	Caffein.....	¼	0.235	0.216	0.226	0	13.6
11572	Blaud's Compound.						
	Ferrous carbonate.....	1	1.54	1.38	1.46	54.0	0
	Arsenious acid.....	1/60	0.0160	0.0143	0.0151	0	14.4
	Strychnin sulphate.....	1/60	0.0189*	0.0169*	0.0180*	13.2*	0*
11593	Blaud's Compound.						
	Ferrous carbonate.....	1	0.93	0.87	0.90	0	13.0
	Arsenious acid.....	1/60	0.0168	0.0157	0.0163	0.6	6.0
	Manganese binoxid.....	1	0.98	0.92	0.95	0	8.0
11585	Bronchitis No. 6.						
	Strychnin sulphate.....	1/60	0.0190	0.0164	0.0177	13.8	1.8
	Terpen hydrate.....	2	1.87*	1.61*	1.74*	0*	19.5*
11575	Calomel Tablet Triturates.						
	Calomel.....	1/10	0.109	0.089	0.097	9.0	11.0
11573	Calomel Tablets.						
	Calomel.....	1/10	0.116	0.094	0.099	16.0	6.0
11627	Calomel Tablet Triturates.						
	Calomel.....	1	0.97	0.85	0.91	0	15.0
11611	Calomel Tablets.						
	Calomel.....	1/10	0.109	0.068	0.094	9.0	32.0
11568	Calomel Tablet Triturates.						
	Calomel.....	1/10	0.107	0.091	0.097	7.0	9.0

* Approximate.

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS—*Continued.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Minimum. grs.	Average. grs.	Maximum Variation from Claim. Above.	Below.
						%	%
11559	Calomel Tablet Triturates. Calomel	1	1.04	0.94	0.99	4.0	6.0
11609	Calomel Tablets. Calomel	2	1.82	1.64	1.73	0	18.0
11586	Calomel Tablets. Calomel	1/10	0.101	0.086	0.097	1.0	14.0
11603	Calomel Tablets. Calomel	1/10	0.108	0.088	0.103	8.0	12.0
11557	Calomel Tablets. Calomel	1/10	0.108	0.098	0.104	8.0	2.0
11595	Calomel Tablets. Calomel	¼	0.253	0.226	0.242	1.2	9.6
11614	Calomel Tablets. Calomel	¼	0.252	0.228	0.242	0.8	8.8
11571	Calomel and Soda Tablets No. 3. Calomel	¼	0.252	0.225	0.240	0.8	10.0
	Sodium bicarbonate	1	1.15	1.03	1.10	15.0	0
11570	Calomel Compound, Tablets No. 6. Calomel	½	0.509	0.456	0.488	1.8	8.8
	Sodium bicarbonate	½(?)	1.93	1.73	1.85	(?)	(?)
11606	Calomel and Soda Tablets. Calomel	1/10	0.107	0.100	0.104	7.0	0
	Sodium bicarbonate	1	1.02	0.96	1.00	2.0	4.0
11578	Cathartic Compound. Calomel	1	1.00	0.92	0.97	0	8.0
11452	Cathartic Compound. Calomel	1	0.78	0.72	0.75	0	28.0
11576	Cold Tablets. Acetanilid	1½	1.39	1.30	1.36	0	13.3
	Caffein citrated	½	0.51	0.47	0.49	2.0	6.0
11618	Cold Tablets No. 2. Quinin sulphate	2	2.05	1.84	1.98	2.5	8.0
11608	Acetanilid Compound Tablets Acetanilid	3½	3.50	3.32	3.39	0	5.1
	Caffein	½	0.50	0.48	0.49	0	4.0
	Sodium bicarbonate	1	1.03	0.97	0.99	3.0	3.0
11626	Acetanilid Compound Tablets No. 4. Acetanilid	3½	3.61	3.36	3.48	3.1	4.0
	Sodium bicarbonate	8/10	0.96	0.90	0.93	20.0	0
	Sodium bromid	1/10	0.091	0.085	0.088	0	15.0
	Caffein citrated	½	0.51	0.48	0.50	2.0	4.0
11444	Acetanilid Compound Tablets No. 17. Acetanilid	3	3.06	2.92	2.97	2.0	2.7
	Caffein citrated	½	0.51	0.49	0.50	2.0	2.0
	Sodium bicarbonate	2	2.02	1.93	1.96	1.0	3.5

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS—*Continued.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Minimum. grs.	Average. grs.	Maximum Variation from Claim. Above.	Below.
						%	%
11622	Migrain Tablets No. 2.						
	Acetanilid	2	2.13	1.90	2.01	6.5	5.0
	Caffein citrated	½	0.52	0.47	0.49	4.0	6.0
11620	Migrain Tablets No. 3.						
	Acetanilid	2	1.95	1.77	1.84	0	11.5
	Caffein citrated	½	0.48	0.41	0.45	0	18.0
11583	Migrain Tablets.						
	Acetanilid	2	2.09	1.78	2.00	4.5	11.0
	Caffein citrated	½	0.52	0.44	0.50	4.0	12.0
11601	Migrain Tablets.						
	Acetanilid	2	2.06	1.81	1.98	3.0	9.5
	Caffein	¼	0.26	0.22	0.24	4.0	12.0
11605	Headache Tablets (Hawley).						
	Acetanilid	2½	2.61	2.46	2.52	4.4	1.6
	Caffein	½	0.50	0.47	0.48	0	6.0
	Sodium bicarbonate	1	1.07	1.01	1.04	7.0	0
11598	Hex-uro-gen.						
	Hexamethylene tetramin..	5	5.65	5.41	5.55	13.0	0
	Acid sodium phosphate...	5	4.60	4.41	4.52	0	11.8
11612	Hexaform Tablets.						
	Hexamethylene tetramine..	5	5.21	4.80	4.98	4.2	4.0
11624	La Grippe Tablets.						
	Acetanilid	1¾	1.95	1.68	1.83	11.4	4.0
	Caffein citrated	½	0.56	0.48	0.53	12.0	4.0
11602	Mercury Protoiodid Tablets.						
	Mercury protoiodid	¼	0.240	0.228	0.233	0	8.8
11566	Myalgie (Dr. Harvey).						
	Sodium salicylate	2	1.38	1.26	1.33	0	37.0
	Acetanilid	2	1.64	1.50	1.59	0	25.0
	Caffein citrated	½	0.32	0.29	0.31	0	42.0
	Cerium oxalate	½	0.46	0.42	0.45	0	16.0
11610	Neuralgie Tablets No. 5.						
	Acetanilid	2	1.98	1.89	1.94	0	5.5
11581	Phenolphthalein Tablets.						
	Phenolphthalein	2	2.27	2.07	2.15	13.5	0
11589	Phenolphthalein Tablets.						
	Phenolphthalein	2	2.03	1.92	1.98	1.5	4.0
11621	Phenolphthalein and Calomel Tablets.						
	Phenolphthalein	1/10	0.117	0.097	0.110	17.0	3.0
	Calomel	1/10	0.111	0.092	0.104	11.0	8.0
11615	Quinin Sulphate Tablets.						
	Quinin sulphate	2	2.00	1.85	1.91	0	7.5
11623	Quinin Sulphate Tablets.						
	Quinin sulphate	2	1.90	1.74	1.81	0	13.0
11590	Quinin Sulphate Tablets.						
	Quinin sulphate	2	2.25	2.01	2.16	12.5	0
11600	Quinin and Nux Vomica.						
	Quinin	1	0.99	0.89	0.94	0	11.0

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS—*Concluded.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Minimum. grs.	Average. grs.	Maximum Variation from Claim. Above.	Below.
						%	%
11574	Sodium Bromid Tablets. Sodium bromid.....	5	5.06	4.89	5.00	1.2	2.2
11450	Sodium Salicylate Tablets. Sodium salicylate.....	5	5.14	4.16	4.56	2.8	16.8
11569	Sodium Salicylate Tablets. Sodium salicylate.....	5	5.07	4.67	4.92	1.4	6.6
11613	Sodium Salicylate Tablets. Sodium salicylate.....	5	4.85	4.57	4.74	0	8.6
11580	Strontium Salicylate Tablets. Strontium salicylate.....	5	4.80	4.27	4.54	0	14.6
11564	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0174	0.0134	0.0152	4.2	19.8
11440	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0192	0.0147	0.0161	15.0	12.0
11597	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/50	0.0095	0.0059	0.0082	0	70.5
11582	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0173	0.0135	0.0154	3.6	19.2
11594	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0169	0.0144	0.0158	1.2	13.8
11604	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0161	0.0149	0.0153	0	10.8

Below is shown a comparison of between Kebler's results in 1914 with 231 lots and our own with 111 samples.

	Kebler. Per cent.	Connecticut. Per cent.
Showing variation less than 10%...	43	44
" " more " 10%...	57	56
" " " " 12%...	44	35
" " " " 15%...	28	26
" " " " 20%...	9	10

The results of the two inspections are strikingly similar.

Twelve of our samples show total variations in weight of 20 per cent. or over. The fact that eight of these contained such potent drugs as corrosive sublimate, acetphenetidin, nitroglycerin and strychnin sulphate, makes the discrepancy a matter of considerable gravity.

Variations in Amount of Medicament in Tablets.

It is of even greater importance, however, to ascertain how closely the composition of the tablets conforms with that claimed

for them on the label. In securing these data it has been necessary to assume that the tablets are of uniform composition, and that the manufacturer has carefully prepared his mix before passing it through the machines. The small quantity of medicament in certain tablets makes the analysis of individual tablets of such drugs almost an impossibility. In the table which follows, therefore, it has been assumed that all the tablets in any one sample were chemically the same and the amounts of medicament recorded for the heaviest and lightest tablets have been calculated from the analysis of a composite of 10, 25 or more tablets. Table XX gives the detailed results in this respect on this year's samples.

Considering the variations both above and below the claimed amounts, we find a wide range, from 54.0 per cent. above to 70.5 per cent. below. The following is a summary of these variations in both directions in the 111 samples:

	Number.	Per cent. of total determinations.
Variations less than 5%.....	169	55
" from 5.00–9.99%.....	56	18
" " 10.00–14.99%...	40	13
" " 15.00–19.99%...	22	7
" " 20.00–29.99%...	10	3
" " 30.00–50.00%...	8	3
" over 50%.....	4	1

That is, 27 per cent. of all the drugs determined varied from the claimed amount by more than 10 per cent. and 14 per cent. by more than 15 per cent.

In the smaller tablets a slight variation causes a relatively large percentage variation, and possibly a comparison based on grains of active drug present is more illuminating. On this basis the following variations from claim are shown:

	Claimed. grs.	Found. Max. grs.	Found. Min. grs.	Maximum Variation. from Claim. grs.	Maximum Variation. from Claim. Per cent.
Acetanilid.....	1.33	1.35	1.21	—0.12	— 9.0
"	1.50	1.30	1.30	—0.20	—13.3
"	1.75	1.95	1.68	+0.20	+11.4
"	2.00	2.13	1.50	—0.50	—25.0
"	2.50	2.61	2.46	+0.11	+4.4
"	3.00	3.06	2.92	—0.08	— 2.7
"	3.50	3.61	3.32	—0.18	— 5.1
Acetphenetidin.....	1.00	0.87	0.80	—0.20	—20.0
Ammonium salicylate....	2.00	1.90	1.70	—0.30	—15.0

	Claimed. grs.	Pound. Max. grs.	Pound. Min. grs.	Maximum Variation. from Claim. grs.	Maximum Variation. from Claim. Per cent
Arsenious oxid	0.0167	0.0168	0.0143	—0.0024	—14.4
Aspirin	1.25	1.15	1.05	—0.20	—16.0
"	5.00	4.66	3.50	—1.50	—30.0
Caffein	0.25	0.260	0.216	—0.034	—13.6
"	0.50	0.50	0.47	—0.03	— 6.0
"	1.00	0.94	0.84	—0.16	—16.0
Caffein citrated	0.50	0.56	0.29	—0.21	—42.0
Calomel	0.10	0.116	0.068	—0.032	—32.0
"	0.25	0.253	0.225	—0.025	—10.0
"	0.50	0.509	0.456	—0.044	— 8.8
"	1.00	1.04	0.72	—0.28	—28.0
"	2.00	1.82	1.64	—0.36	—18.0
Cerium oxalate	0.50	0.46	0.42	—0.08	—16.0
Corrosive sublimate	7.00	5.78	4.94	—2.06	—29.4
" "	7.30	7.79	7.08	+0.49	+6.7
Ferrous carbonate	1.00	1.54	0.87	+0.54	+54.0
Hexamethylene tetramine	5.00	5.65	4.80	+0.65	+13.0
Manganese binoxid	1.00	0.98	0.92	—0.08	— 8.0
Mercury iodid	0.375	0.361	0.326	—0.049	—13.1
Mercury protoiodid	0.25	0.240	0.228	—0.022	— 8.8
Phenolphthalein	0.10	0.117	0.097	+0.017	+17.0
"	2.00	2.27	1.92	+0.27	+13.5
Potassium iodid	2.00	1.91	1.70	—0.30	—15.0
Quinin sulphate	1.00	0.99	0.89	—0.11	—11.0
" "	2.00	2.25	1.74	—0.26	—13.0
Sodium bicarbonate	0.80	0.96	0.90	+0.16	+20.0
" "	1.00	1.15	0.96	+0.15	+15.0
" "	2.00	2.02	1.93	—0.07	— 3.5
Sodium bromid	0.10	0.091	0.084	—0.015	—15.0
" "	5.00	5.06	4.89	—0.11	— 2.2
Sodium phosphate, acid	5.00	4.60	4.41	—0.59	—11.8
Sodium salicylate	2.00	1.38	1.26	—0.74	—37.0
" "	5.00	5.14	4.16	—0.84	—16.8
Strontium salicylate	2.00	1.90	1.75	—0.25	—12.5
" "	5.00	4.80	4.27	—0.73	—14.6
Strychnin sulphate	0.0167	0.0192	0.0134	—0.0033	—19.8
" "	0.0200	0.0095	0.0059	—0.0141	—70.5
Terpen hydrate	2.00	1.87	1.61	—0.39	—19.5

While the composition of the tablets agrees as a rule very satisfactorily with that claimed, the above table shows that the individual variations are far too wide. Moreover, the maximum variation is more often below than above the amount claimed, only 9 of the 47 drugs determined showing a maximum above the claim.

These variations for the whole 111 samples of tablets may be summarized as follows:

	Number.	Per cent.
Variation less than 5%.....	11	13
" " " 10%.....	30	37
" " " 15%.....	47	57
" " " 20%.....	62	75
" " " 30%.....	73	89
" " " 50%.....	78	95
" more " 50%.....	4	5

In other words, in more than one-third of the determinations the variation from the claim amounts to over 10 per cent. in more than one-half to over 15 per cent., in one-fourth to over 25 per cent., while in 4 drugs the maximum variation amounts to from 54 to 70.5 per cent.

Judging by examinations made by Kebler and by ourselves in past years, tablets taken from the stocks of druggists show quite as great variations as these. It is the tablets themselves we criticize, not the persons who happen to sell or dispense them.

TOILET PREPARATIONS.

At the last session of the Legislature an act was passed forbidding the use of wood alcohol in any preparation intended for internal or external use; and if used in products intended for technical purposes a poison label on the container is required.

To test the observance of this law the Dairy Commissioner submitted 25 samples of toilet preparations taken from the stock of dealers in barbers' supplies. The results of our examination of these are given in Table XXI.

Twelve of the 25 samples contained wood alcohol in amounts ranging from about 11 per cent to 84.80 per cent. Not only was this use of wood alcohol illegal, but in no instance was its presence in these samples stated on the label. Sample **12216**, although claiming 90 per cent. methyl alcohol, contained only 39.20 per cent. alcohol all in the form of ethyl. Sample **12209** claimed "menthol" alcohol, whatever that is, and contained 39.56 per cent. methyl alcohol. Five samples claimed to be bay rum, which if of standard quality should contain about 58 per cent. of grain alcohol; they actually contained 30.64 per cent. alcohol (28 per cent. of which was methyl), 15.00 per cent. grain alcohol (30 per cent. claimed),

TABLE XXI.—TOILET PREPARATIONS.

Sample No.	Dealer.	Brand.	Specific gravity @ 15.6° C.	Total alcohol by vol.	Per cent. of total alcohol in form of methyl.
12205	A. Amico, Seymour.....	Imported Bay Rum (C. A. Johnson, New Haven).....	0.9536	39.64	28.83
12206	" " "	Bayryber Toilet Water (F. J. Mangini, Waterbury).....	0.9496	40.60	100.00
12214	T. Baker, Danbury.....	Unexcelled Herb Rub (Rich. Lenroth, Jersey City).....	0.9778	21.96	0
12215	Frank Dieli, Bridgeport....	Bouquet de Fleurs.....	0.9974	3.00	0
12216	" " " ...	Circassian Hair Dressing.....	0.9610	39.20[1]	0
12217	" " " ...	Domestic Bay Rum.....	0.9811	15.00[2]	0
12223	Jos. Fanighetti, Waterbury	Extr. Witch Hazel (C. A. Johnson, New Haven).....	0.9877	8.90	0
12207	C. A. Johnson, New Haven	Imported Bay Rum.....	0.9536	40.32	27.80
12208	" " " " "	Letonneaux Eau de Quinine.	0.9193	59.60[3]	0
12209	" " " " "	Bouquet Toilet Water.....	0.9530	39.56[4]	100.00
12219	G. Lupo, New Haven.....	Bay Toilet Water.....	0.9656	27.52	100.00
12220	" " " "	Superior Hair Tonic.....	0.9562	36.92	100.00
12224	F. J. Mangini, Waterbury.	Hoffmann's Hair Tonic.....	0.9477	43.12	0
12210	A. Palmer, Bridgeport.....	Quinine Tonic Comp. (Rich. Lenroth, Jersey City).....	0.9599	37.56	0
12211	" " "	Glacier Scalp Rub (Rich. Lenroth, Jersey City).....	0.9367	48.24	0
12200	N. Seidman, Hartford.....	Eau de Quinine.....	0.9678	29.64[5]	47.67
12201	" " "	Sage Head Rub.....	0.9611	34.20[6]	0
12202	" " "	Floral Bouquet Toilet Water.	0.9555	37.92[7]	0
12218	E. F. Stefhan, New Haven.	Violet Toilet Water.....	0.9674	28.36	0
12222	R. F. Surinek, Bridgeport..	Remo Bay Rum (Remo Co., Bridgeport).....	0.8730	84.80	100.00
12221	" " " " ..	Remo Quinine Hair Tonic (Remo Co., Bridgeport)...	0.9101	70.60	100.00
12212	J. Tavano, Bridgeport.....	Carnation Hair Dressing (Barber Supplies Co., Bridgeport).....	0.9631	29.00	100.00
12213	" " "	Comtesse Aime Bay Rum (Perfumerie Comtesse Aime Paris).....	0.9726	23.24[8]	0
12203	E. Warshaw & Co., Bridgeport.....	Carnation Hair Tonic.....	0.9636	30.00	100.00
12204	" " " " "	Eau de Quinine Hair Tonic..	0.9375	51.32	100.00

[1] Claimed 90% ethyl alcohol.
[2] Claimed 30% grain alcohol.
[3] Claimed 62% alcohol.
[4] Claimed 50% menthol alcohol.
[5] Claimed 50% grain alcohol.
[6] Claimed 45% grain alcohol.
[7] Claimed 40% grain alcohol.
[8] Claimed 25% grain alcohol.

40.32 per cent. (all methyl), 84.80 per cent. ethyl, and 23.24 per cent. ethyl (25 per cent. claimed). Similarly the one sample of extract of witch hazel, which should contain at least 14.25 per cent. of grain alcohol, contained only 8.90 per cent.

The following is a summary of the examination:

Containing wood alcohol:

12205 Johnson's Imported Bay Rum.
12207 " " "
12209 " Bouquet Toilet Water.
12206 Mangini's Bayryber Toilet Water.
12219 Lupo's Bay Toilet Water.
12220 " Superior Hair Tonic.
12200 Seidman's Eau de Quinine.
12222 Remo Bay Rum.
12221 " Quinine Hair Tonic.
12212 Carnation Hair Dressing.
12203 Carnation Hair Tonic.
12294 Warshaw's Eau de Quinine Hair Tonic.

Containing less grain alcohol than standard:

12223 Johnson's Extr. Witch Hazel.

Containing less alcohol than claimed:

12216 Dieli's Circassian Hair Dressing.
12217 " Domestic Bay Rum.
12208 Johnson's Letonneaux Eau de Quinine.
12209 " Bouquet Toilet Water.
12200 Seidman's Eau de Quinine.
12201 " Sage Head Rub.
12202 " Floral Bouquet Toilet Water.
12213 Comtesse Aime Bay Rum.

MISCELLANEOUS DRUGS.

11324. *Watkins Cough Medicine*, The J. R. Watkins Medicine Co., Winona, Minn. "Alcohol 11 per cent., chloroform 4 min. per oz."

Spec. grav. @15.6° C.	1.2352
Alcohol by volume	12.73
Solids	59.08
Ash	0.30
Chloroform	0.67
Sugar	present
Alkaloids	present
Gelsemium	indicated
Saccharin	present
Morphin, opium, cocain	absent

This is a sugar syrup containing alcohol, chloroform, saccaharin and gelsemium.

11325. *Watkins Catarrh Relief*, The J. R. Watkins Medicine Co., Winona, Minn. " 2.5 grs. chloterone per av. oz."

Loss — 100°C.	3.43
Chloretone	0.45
Volatile oils, menthol	present
Alkaloids	absent

The above medicine was tested chiefly for the chloretone. The base was a mixture of a non-saponifiable hydrocarbon and a fat.

12225. *Hanford's Balsam of Myrrh*, G. C. Hanford Mfg. Co. " Wood alcohol 84%." This was tested only for methyl (wood) alcohol, of which it contained 88.96 per cent. by volume. Its sale is illegal in this state.

12226. *Elastic Soluble Gelatine Capsules No. 49 Santal Oil, 10 minims*, American Druggists Syndicate, Long Island City, N. Y. Cost $3.25 per 100 capsules. The capsules contained on the average 8.65 minims of santal oil. The oil showed a specific gravity @ 25° C. of 0.9726, an optical rotation of —15.7 @ 20° C. in a 100 mm tube, and contained 95.90 per cent. of total alcohols calculated as santalol.

5583. *Koch's Celebrated Hair Dye.* Sample consisted of two bottles. Bottle 1 contained a clear, yellow liquid which darkened on exposure to the air; it consisted of a solution of pyrogallol in water (2.858 gms. per 100 cc.). Bottle 2 contained a clear liquid with an ammoniacal odor. It consisted of an ammoniacal solution of silver nitrate (0.771 gm. of silver nitrate and 5.75 gms. of ammonia per 100 cc.).

12150. *Silicate of Soda*, dist. by The Talcott Co., Hartford. It contained 28.44 per cent. silicic oxid and 0.04 per cent. suspended matter; sodium was present, and a very slight amount of iron and alumina. **11744.** *Turpentine*, General Naval Stores Co., New York. It had a specific gravity @ 15.6° of 0.8605 and a refractive index @ 20° C. of 1.4685; it had an initial distillation temperature of about 150° and about 93 per cent. distilled under 170°; unpolymerized residue 3.2 per cent. Sample passed.

MISCELLANEOUS SAMPLES SENT BY PRIVATE INDIVIDUALS.

Anzac. A sample of this temperance beer contained 0.25 per cent of alcohol by volume.

Butter. Thirteen samples were tested, of which 8 were genuine, 2 were oleomargarine, 2 were renovated butter, and one contained the excessive moisture of 38.3 per cent.

Butter Color. The sample examined was annatto in oil solution.

Coffee. The single sample tested showed no adulteration.

Coffee Wax. A substance obtained during the refining process for caffein contained water 6.27, ash 2.10, protein (N x 6.25) 19.00, ether extract 71.31, and nitrogen-free extract 1.32 per cent.

Coffee Residue. A residue from the manufacture of Kaffee Hag. The coffee is dry charred before treatment with the solvent, and the solution containing the caffein is filtered this residue being left. It contained

Water	8.57	Nitrogen-free extract	52.11
Ash	10.79	Total nitrogen	1.90
Protein (N x 6.25)	11.88	Total phosphoric acid	0.24
Ether extract	0.25	Potash, water-soluble	4.10
Fiber	16.40		

Confectionery. A sample of *Lolly Pops* suspected of having cuased sickness was examined. No heavy metals or alkaloids were found; the color was a mixture of caramel and a small amount of Orange I.

Cottage Cheese. Old Fashioned Cottage Cheese, made by Benvenuto Farm, West Bloomfield. It contained.

Water	26.28	Ash	1.57
Solids	23.72	Lactic acid	0.76
Protein	17.61	Lactose, etc.	1.38
Fat	2.40		

Cream Nine samples were tested containing from 17 to 39 per cent. of butter fat; two of these contained sucrate of lime.

Fish. Two samples were tested for preservatives with negative results.

Flour. The sample tested was not adulterated.

Grape Juice. A sample suspected of containing poison was found normal in all respects.

Ice Cream. The three samples tested contained from 10.27 to 11.92 per cent. of butter fat.

Maple Syrup.. The sample tested contained 66.70 per cent. solids, 0.69 ash and had a Winton lead number of 1.36 (2.04 on dry basis).

Milk. Twenty-four samples were tested, of which 10 were genuine, 12 were below standard, 1 was watered and 1 was both skimmed and watered.

Olive Oil. The sample examined was very largely, if not entirely, peanut oil.

Peanut Butter. A sample sold by the Great Atlantic and Pacific Tea Co. contained the following:

Water	1.93	Fat	45.97
Ash	2.99	Fiber	1.59
Protein (N x 6.25)	28.13	Nitrogen-free extract	19.19

Salt Pork. A sample of the brine and one of the meat itself, each contained boric acid and nitrates.

Semolina. Sample of two cars sold by L. A. Viviano, New York, were analyzed with the following results:

	1st car.	2nd car.
Water	12.53	13.23
Ash	0.70	0.65
Protein (N x 6.25)	13.13	12.63
Fiber	0.27	0.24
Fat	1.14	1.07
Nitrogen-free extract	72.23	72.18

Sludge from Gas Co. The sample contained water 65.00, ash 29.04, organic and volatile matter 5.96, lime 15.94, magnesia 0.91, total sulphuric anhydrid 0.47, water-soluble sulphuric anhydrid 0.35 per cent.

Sugar. Three samples were tested, two of which were not adulterated. The third sample contained 0.86 per cent. of sulphuric acid, probably an accidental contamination acquired during transportation.

Tobacco Dust. The sample tested contained 1.22 per cent. of nicotin.

Vanilla Extract. A sample of *Thompson's Extract of Vanilla*, made by C. S. Lettell and Co., New York, contained 0.185 per cent. of vanillin with no coumarin.

Vinegar. Forty-four samples were tested, of which 31 conformed to the state standard. Three were below standard in acidity, 5 in solids and 4 in both acidity and solids. One sample contained 0.131 gm. of zinc per 100 cc.

Water. The sample tested showed 8.9 parts per million of chlorin, 414.0 parts of sulphuric anhydrid and less than 0.1 part of iron.

Whisky. Two samples were tested which contained no adulteration.

Wine. The single sample tested contained 11.90 per cent. of alcohol by volume.

Alcohol. The sample tested contained 89.7 per cent. of ethyl alcohol by volume.

B-K Bacili-Kil, made by General Laboratories, Madison, Wis. The material was an aqueous solution of alkaline earth and alkali hypochlorites; it contained approximately 3.41 gms. of available chlorin per 100 cc.; calcium, magnesium, sodium, potassium, and hypochlorites present; no heavy metals.

Police Cases. Three suspicious samples of drugs were sent to us by the local police. One was heroin hydrochlorid, one morphin sulphate, while the third was an abortion medicine consisting chiefly of ferrous iron and aloes. No ergot, savin, pennyroyal or alkaloids were detected.

Prescriptions. A sample of 3 gr. phenacetin in powders suspected of substitution was examined; the prescription was genuine. Another prescription supposed to consist of two parts bismuth subcarbonate and one part magnesium peroxid, was tested quantitatively and bismuth, magnesium, carbonates and peroxids were found.

Samples suspected of containing poisons. Twelve samples of this kind were examined. A milk suspected of containing carbolic acid was found to contain that drug. Another suspected milk was found normal in all respects. A sample of suspected raspberry jam contained no alkaloids or heavy metals. A sample of bird pie contained much free yellow phosphorus. A sample of wheat bran was tested with negative results. The contents of a cow's stomach were found to contain zinc; two samples of paint to which it was suspected the cow might have had access contained no zinc, one being a lead pigment and the other a mixture of lead chromate and Prussian blue. A sample of *Baby Buster Scratch Feed* alleged to have caused the death of 45 young chickens, was fed to two chickens for four days with no bad effects. A hen and a rooster, which were suspected of having been poisoned, were examined; no metallic poison was detected; the crops were gorged

with food and greatly distended, the lungs congested; the birds appeared to have died of suffocation rather than of poison. The contents of a dog's stomach were examined and a large quantity of mercury, probably derived from corrosive sublimate, was found. A red powder found scattered in a pig pen was tested for alkaloids and metallic poisons with negative results; iron, lime and sulphates were present in abundance.

Summary of Examinations.

Sampled by Station:

Canned Beans	62	Prepared Flours	6
Bread (weights only)	265	Fruit Juices	5
Bread Materials	56	Infant Foods	2
Breakfast Foods	30	Jelly Powders	3
Brosia Meals	4	Malt Extracts	3
Chocolate and Cocoa	5	Malt Flours	4
Condensed Coffee	1	Temperance Beverages	4
Coffee Substitutes	6	Miscellaneous Foods	17
Cordials	27	Dried Vegetables	18
Diabetic Foods	8	Drug	1
Flavoring Extracts	9		
		Total	536

Sampled by Dairy Commissioner:

	Total.	Adulterated.		Total.	Adulterated.
Butter	14	3	Spices	52	7
Cocoa	1	0	Sugar	5	1
Cream	8	0	Vinegar	40	5
Eggs	6	6	Physician's Drugs	76	15
Hamburg Steak	34	14	Toilet Preparations	25	19
Milk	390	258*	Miscellaneous Drugs	6	1
Sausage	21	5			
			Total	678	334*

Sent by Private Individuals	140	44

Total samples examined.....1354

* Including 118 samples of milk deficient only in solids—not—fat.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 201 JANUARY, 1918

ECONOMY IN FEEDING THE FAMILY

III

Food Oils and Fats

By E. M. BAILEY

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Food Oils and Fats

Chemically all fats resemble one another in that they are combinations of fatty acids with glycerin. Physically they differ in that some are liquid while others are solid. The term "fixed" or "fatty oil" is generally applied to those fats which, at the ordinary temperatures, remain in the liquid condition, but chemical industry has eliminated this natural distinction by the introduction of the "hydrogenating" or "hardening" process which converts liquid oils into the solid state.

As food stuffs fats belong to the same category as sugars, i. e., they are chiefly energy producers, in contrast with protein foods which are, in addition, tissue builders. When taken with other food in the diet, fats (and sugars) have the property of reducing the protein requirements of the body and this is what is meant by their so-called protein-sparing action. The calorific (energy-producing) value of fat is about 2.25 times as great as that of either protein or sugar, and it is practically the same regardless of the particular source of the fat or oil, or whether it be of animal or vegetable origin. By accurate measurement it has been found that one ounce of fat yields 264 calories to the body. On the basis of calorific values, substitutions among fatty foods in the diet may be made with considerable freedom, but personal tolerance, preference, or prejudice, will influence the choice in this as in other types of foods.

Although so nearly alike in energy-producing capacity, the fats show differences in other nutritional aspects. We refer especially to the growth-promoting properties possessed by some fats and lacking in others. It has been shown[1] that butter possesses this peculiar efficiency to a marked degree and that the efficiency resides in the butter fat itself. This shows us an additional and important reason for the effectiveness of milk as a food for children. Other fats show this property, among them beef fat, and, as

[1] Osborne and Mendel Jour. Biol. Chem. **16.** 423–37 1913; ibid **20,** 379–90, 1915.

might be expected from their ingredients, the oleomargarines made of the so-called oleo-oil from beef fat. Lard and olive oil lack this peculiar property, as do those margarines also which are made from the commonly used vegetable fats and hydrogenated oils; as has been shown by Halliburton and Drummond.[1] The particular substances or properties responsible for this phenomenon are obscure, and as yet unidentified components of the fats. They have been detected in other types of food, and for lack of better definition have been called "vitamines" or "accessory diet factors."

Fatty foods not possessing the virtue just mentioned should not, however, be discriminated against on this account when used in the ordinary liberal diet, but it would appear to be inadvisable to eliminate butter entirely from the menu, particularly that of children.

We have referred already to the process of "hydrogenation," by which the physical and chemical characters of fats are modified, the conspicuous physical change being that liquid fats are hardened and converted into solids. The question of the wholesomeness and digestibility of fats so treated at once presented itself. The considerable amount of work which has been done on this subject has not resulted in anything to prejudice us against the use of products so treated. Upon this point Ellis[2] says: "It seems to be generally accepted by those who have investigated the matter, that the hydrogenated oils have as desirable a degree of digestibility as the oils from which they are derived." The debate as to their suitability for food has centered chiefly upon the presence of certain metals, more particularly nickel, which are used in the process of their manufacture. The amounts of nickel retained in the finished product, in the case of some hardened cottonseed oils, has been determined and quantities ranging from .020 to .075 milligrams per kilo (1,000 grams) found. The significance of such figures is better understood by comparing them with the quantities of nickel acquired by various foods prepared in nickel-lined cooking utensils which have been in common use for some years. Spinach contained from 25 to 27 milligrams per kilo; peas, 12 to 16; plums, 35; fruit cooked in 2% acetic acid (about one half the acid strength of ordinary vinegar), 65 to 67; cabbage, 83; sour-kraut, 127; potato, 80. No injurious effects have been attributed

[1] Jour. of Physiol., LI., p 250.

[2] Hydrogenation of Oils, Van Nostrand & Co., 1914, p. 144.

to the use of foods so prepared, yet it is seen that they contain amounts of nickel one thousand or more times greater than has been found in the hardened oils examined. However, it is perfectly obvious that this phase in the production of hydrogenated products should be carefully controlled.

The inspection of foodstuffs such as, of necessity, more and more engrosses the attention of this laboratory, involves tests for purity and tests to determine truthfulness of label or guaranty. When such inspections result in the detection of substances positively poisonous or deleterious to digestion and health, their value from the standpoint of public health is obvious to all. But instances of flagrant and vicious adulteration are largely passing out of the experience of the food control chemist of to-day, so that frequently the results of his labors lie within the realm of public health in its broader sense, which includes public economy. The substitution of one edible oil wholly or in part for another, and the sale of such substitute does not constitute a sin against the consumer's digestion, but it does defraud him of the difference in commercial values between the product he actually gets and that which he thinks he is buying. And now more than ever before he is anxious to protect himself in this direction. It is intended that our analyses should guide the consumer to intelligent purchasing; aid him to a better appreciation of comparative food values, and foster alertness to the deceptions of flashy labels and cunning advertising literature. Particularly at this time we desire to help him to co-operate in the program of economy that is being urged upon us.

These general considerations seem justified, in view of recent inquiries which have come to us on this subject. In addition we shall indicate briefly the source, preparation and composition of the principal fatty foods and summarize our accumulated experience with them. We shall include also some analyses not heretofore published, and some data, not our own, which may be of interest from a culinary standpoint.

Any classification of edible fats on the basis of their domestic uses will necessarily include the same fat in two or more classes, but for convenience we shall group them as follows: (1) Salad Oils. (2) Cooking fats and (3) Butter and its substitutes.

SALAD OILS.

Olive Oil. The oil supplied by the fruit of the olive tree has been used as a food by man since the earliest times. Grown originally in oriental countries, its cultivation and use have extended through Mediterranean countries to South America, and it is now grown to a considerable extent in the United States, notably in California and Arizona.

About 50% of the fleshy part of the olive fruit is oil. The best grades of oil are prepared from fruit picked by hand just before maturity. These are crushed and the oil removed by gentle pressure, the first run being called "Virgin" oil or Sublime. This is generally characterized by a distinct greenish tinge of color due to the chlorophyll which is associated with the oil in the plant cells. Genuine oil may, however, lack this characteristic and may be pale or even deep yellow. Admixtures of peanut, sesame, poppy seed, corn and cottonseed oils with olive oil are much less common than formerly, although blending of inferior grades; i. e., oil obtained from repressings of the olive pulp, with higher grades is practiced to some extent in Europe.

Cottonseed Oil. A keen competitor of olive oil for table use is the refined oil of the cottonseed. Although produced in countries of Europe, Asia and South America, it is essentially an industry of the United States, where methods of refining lead those of other countries. The oil is unfit for use until it has been refined, which process includes deodorizing, decolorizing and "chilling," the latter step removing the high-melting fatty constituent (stearin), which would cause the oil to "cloud" in cold climates.

Corn Oil. In the process of making starch and glucose from maize or Indian corn the germ of the seed is removed. This germ contains about 15% of oil and yields the corn oil now appearing in our market. It is golden yellow in color and has a pleasant odor and taste.

A sample of corn oil examined in this laboratory[1] was found to be mixed with other oils, chiefly cottonseed oil. Thus early has this product been dignified and commercially flattered by adulteration.

Peanut Oil. Next in importance is peanut oil, of which there is an increasing production in the United States. Like cottonseed

[1] Connecticut Food & Drug Report, 1905, p. 121.

oil it must be refined before it is marketable as a food oil. The refined oil has a distinct nutty flavor which commends itself to some tastes.

Other Oils. Oils of the poppy-seed, rape, sesame and sunflower are not used alone to any extent in this country, but some of them may occur in admixture with the oils described above, either as adulterants or in legally marked compounds.

The commercial value of the oils described is in about the following order: olive, peanut, corn, cottonseed, the values of the others being intermediate between peanut and corn oils.[1]

Summary of the Results of Our Inspections of These Products.

Between 500 and 600 samples of olive oil have been examined in this laboratory since 1897, chiefly represented by six inspections. The percentage of total adulteration decreased from a maximum of 40% found in 1900, to 13.7% in 1909. It has been found that this product, put up in sealed containers, is freer from adulteration than that purchased in bulk from druggists, although the quality of druggists' goods has shown improvement. The general improvement is due in part to more truthful labeling practiced since 1905.

The following tabulation[2], representing 448 samples, illustrates this point. No figures are given subsequent to 1909, because no representative number of samples has been examined in any one year.

Table I.—Summary of Inspections of Olive Oil.

	Year	Not found adulterated	Adulterated	Per cent. Adulterated
From Grocers	1897	37	23	38.3
	1900	45	28	38.4
	1905	19	0	0.0
	1906	25	0	0.0
	1907	7	0	0.0
	1909	44	0	0.0
From Druggists	1897	13	5	27.8
	1900	17	13	43.3
	1905	21	9	30.0
	1906	55	11	16.7
	1907	65	11	14.5

[1] Leach, Food Inspection and Analysis, p. 516.

[2] Conn. Food & Drug Report, 1909–10, p. 214.

The adulterations found in these inspections were cottonseed, sesame and peanut oils. Such admixtures, as we have noted above, do not constitute a menace to health, and, if properly labelled, would not constitute an infringement of law.

Products sold under the name of "Salad Oil" our examinations have shown to consist wholly or in part of cottonseed oil. Such products are legally labelled; they do not purport to be any single oil and are sold under a distinctive name. Our experience has been, however, that they are often sold upon request for olive oil.

No oil other than olive should be sold as "sweet oil."[1]

COOKING FATS.

The fats chiefly used by our grandmothers for culinary purposes were the rendered fats of hogs or beef, known respectively as lard or beef suet. To-day the housewife has a large array of shortening compounds at her disposal. These nearly always appear under trade names but may contain both the animal fats mentioned combined with a vegetable oil, such as cottonseed oil, or they may be entirely of vegetable origin. Other oils mentioned in the preceding section also occur in these compounds; any of them are adaptable to such use.

Our examination of some of the products in this group indicates their essential constituents to be as follows: Cotosuet[2], cottonseed oil and beef fat; Cottolene[3], cottonseed oil and beef fat; Korno[4], corn oil, cottonseed oil and a harder fat like stearin; Waverly shortening[5], beef stearin and cottonseed oil; Crisco, hardened vegetable oil, probably cottonseed; Vegetole, vegetable product containing cottonseed oil; Kuxit, vegetable product having the character of cocoanut fat; Wesson oil, cottonseed oil; Mazola, corn oil. A sample of Lard oil[6], said to have been used for deep frying, was found to contain about half its weight of mineral oil. This mixture is unique for food purposes but common as a lubricant.

Recent analyses of some of these fats are given in Table II.

[1] U. S. Food Inspection Decision No. 139; Conn. Rules & Regulations No. 43.

[2] Connecticut Food Report 1896, p. 23.

[3] Connecticut Food Report 1896, p. 23, 1900, p. 145.

[4] Connecticut Food Report 1906, p. 122.

[5] Connecticut Food Report 1909, p. 278.

[6] Connecticut Food Report 1900, p. 148.

TABLE II—ANALYSES OF COOKING FATS.

No.	Brand.	Moisture.	Protein (N x 6. 25)	Ash.	Fat.	Free fatty acids as Oleic.	Refractometer reading at 40°C.	Reichert-Meissel No.	Halphen test.	Nitric Acid test.
		%	%	%	%	%				
8164	Wesson Oil	0.06	....	....	99.94	0.06	59.5	1.04	Red	Br. yellow
8165	Mazola....	0.00	....	....	100.00	0.17	62.5	0.86	Yellow	Red brown
8166	Vegetole...	0.02	0.38	0.02	99.58	0.15	59.5	0.45	Deep Red	Red brown
8167	Cottolene..	0.02	0.31	0.08	99.59	0.10	56.0	0.48	Deep Red	Red brown
8183	Crisco.....	0.20	0.19	0.05	99.56	0.18	54.7	0.50	Br. yellow	Br. yellow
8184	Kuxit.....	0.31	0.13	0.03	99.53	0.15	37.0	5.03	Yellow	Yellow

The analyses show that the samples contain only traces of moisture and are practically all fat. The percentage of free fatty acid is very low. These are the substances prominently concerned in the changes which result in rancidity. A rancid fat or oil is one in which a part of the fat has been decomposed, by enzyme action it is believed, into free fatty acids and glycerine. The action of light and air upon these fatty acids produces the substances of disagreeable taste and odor associated with rancidity. An excess of free fatty acids does not necessarily indicate rancidity, but the conditions are favorable for rancidity to occur.

Edible fats and oils should be kept in securely closed containers protected from sunlight. Oils are more likely to become rancid than are solid fats. It is claimed as one of the advantages of hydrogenation that fats so treated remain wholesome for long periods.

Particular attention, with respect to the presence of animal fats, has been given to those products claiming to be of purely vegetable origin. In none of them have we found evidence of cholesterol, a characteristic constituent of animal fats. The following appear to be pure vegetable products, as claimed: Wesson oil; Mazola; Vegetole; Crisco; Kuxit.

There are few precise physical or chemical data by which to decide the desirability of one fat over another for culinary use. The housewife learns and decides by her experience which to use, judging by the results obtained. One thing she avoids, however, is the use of "smoky" fats for deep frying. The reason for this is that such a fat or oil "smokes" and gives off disagreeable vapors,

which will be absorbed by the food, before the desired cooking temperature is obtained. A desirable fat for deep frying, then, should have a sufficiently high burning point or smoke test. Blunt and Feeney[1] have determined this for a number of common cooking fats and their results are given here as of interest. The temperatures given indicate the degree of heat acquired by the fat or oil at the time it begins to give off visible fumes or vapors. The degrees have been converted to the ordinary Fahrenheit scale.

TABLE III.

Cottonseed oil (Wesson)	451°
Snowdrift	450°
Crisco	448°
Leaf lard	430°
Butter fat	406°
Leaf lard heated 5 hrs	405°
Bulk lard	381°
Olive oil	347°
Peanut oil (1)	323°
Peanut oil (2)	300°
Cocoanut oil	277°

The recognized temperature for deep frying is 350°—400° F. It is apparent, then, that those fats decomposing below that temperature are not well suited to this particular purpose.

BUTTER AND ITS SUBSTITUTES.

Butter. A typical butter contains about 15% of water and 85% of solids, of which 82.5% is milk fat and 2.5% other milk constituents and salt.

Renovated Butter. Renovated butter is made by melting genuine butter and separating the curd and water-soluble constituents of the original product. The fat so obtained is rechurned with milk or cream, or both, and no other substances added except salt. Like butter, it must contain 82.5% of milk fat. The object of this treatment is to save butter which has become rancid or fallen off from prime quality.

Oleomargarine is a product which varies as to proportionality of ingredients and, to some extent, as to character of ingredients, but generally it consists of oleo oil, neutral lard, butter, milk, cream and salt. Vegetable oils, such as cottonseed oil, may be used in the mixture.

[1] Jour. of Home Economics, 7, p. 535, 1915.

Rigid rules are in force to govern the sale of both renovated butter and oleomargarine, in order to protect the butter industry. The controversy which has existed for many years concerning oleomargarine and butter is unfortunate, as each might well have its proper place in the trade. The tax placed upon oleomargarine has increased the price to the consumer for this perfectly wholesome and nutritious product.

Nut Margarine. There have quite recently appeared upon the market a number of brands of nut margarines. These products consist chiefly of cocoanut fat, with admixtures of cottonseed or other vegetable oils. The fats are churned with milk* and salted, as in the preparation of butter. Color capsules accompany the package for the use of the consumer if he desires to color the product. It is not colored by the manufacturer as he is required to conform to regulations similar to those governing the sale of oleomargarine. The coloring we have found to be the vegetable color annatto, which is largely used for butter coloring.

Our analyses of some of these products are given in Table IV.

The analyses show some variation in water content but none contains excessive amount. All contain over 82.5% of fat. The ash varies considerably, due, in all cases, to the salt added. The free fatty acids are within normal limits for these products. Other tests must be interpreted with the knowledge that hydrogenation modifies them very materially. Nos. 8169 and 8170 are declared to contain 0.1% of benzoate of soda; they did not contain amounts in excess of this figure. No. 8168 made no statement as regards preservative; no preservative was found.

The diagnosis of mixtures of this kind is more difficult for the reason that hydrogenation changes the chemical as well as the physical properties of fats, so that their response to the usual tests is either modified or destroyed.

As we have stated elsewhere in this paper, nut margarines are supposedly composed of vegetable fats only, while in oleomargarine animal fats are used, with or without fats of vegetable origin. As in the case of cooking fats, we have looked particularly for evi-

* The flavor of butter is due to the action of lactic acid-forming bacteria in the milk from which it is churned. Nut margarine fats are ripened with milk to which a culture of such bacteria has been added to impart the flavor of butter. [Pickard. The Am. Food Jour., Jan. 1918.]

TABLE IV—ANALYSES OF BUTTER SUBSTITUTES.

Number	Brand	Moisture.	Protein (N x 6. 25.)	Ash.	Fat.	Free fatty acids as Oleic.	Refractometer reading at 40° C.	Reichert-Meissel No.	Halphen test.	Nitric Acid test.
	Nut Margarine.	%	%	%	%	%				
8168	A 1 Brand, Downey Farrell Co., Chicago...	10.84	1.25	4.51	83.40	0.45	40.0	7.00	Deep pink	Brown
8169	Cocoanut Brand, Nucoa Butter Co., Soho Park, N. J.	6.53	0.69	1.58	91.20	0.39	37.2	7.50	Yellow	Brown
8170	Providence Churning Co., Prov., R. I.	11.28	0.75	1.14	86.83	0.47	39.0	6.15	Yellow	Yellow
	Oleomargarine									
8171	Lily, Swift & Co..	1.67	0.56	0.41	97.36	0.74	52.0	1.50	Deep red	Red brown
8172	Premium, Swift & Co.....	2.54	0.63	0.60	96.23	0.63	49.2	0.99	Red	Red brown
8173	Gilt Edge, John F. Jelke Co.	8.52	1.25	1.62	88.61	0.74	49.2	....	Pink	Red brown
9994	Good Luck, John F. Jelke Co.	9.20	1.00	3.08	86.72	0.50	49.3	....	Red	Red brown
8175	Silver Churn, Armour.....	4.90	0.56	1.44	93.10	0.80	51.0	1.30	Deep red	Red brown

dence of animal fats in the nut margarines but with negative results. There is nothing shown by our analyses inconsistent with the claim that they are vegetable products. They are very palatable preparations and may well be substituted for a part of the family butter supply, thereby conserving animal fats.

MILK-BUTTER MIXTURE.

The present is a fruitful time for invention and device designed to appeal to public economy. Such a device is one advertised of late, for which it is claimed that two pounds of butter or table butter can be made from one pound of butter and one pint of milk. While the fine distinction is made that you start with butter and milk and produce "table" butter, no distinction is made between the commercial values of the two substances. Both the expressed and implied thought is that from one pound of butter at (say) 55 cents per pound and one pint (pound) of milk at 7 cents per pint, two pounds of butter or "table" butter are produced, valued at $1.10.

The true story of this economic idea may be simply told by the following table:

Substance.	Composition.	Food Value Calories.	Commerical Value.
1 lb. Butter	85 parts solids, 15 parts water, 82.5 parts fat.	3478	$0.55
1 lb. Milk[1]	12 parts solids, 88 parts water, 4.0 parts fat.	305[2]	0.07
2 lbs. Milk-Butter mixture	97 parts solids, 103 parts water, 86.5 parts fat.	3783	1.10
or per lb. mixture	48.5 parts solids, 51.5 parts water, 43.3 parts fat.	1892	0.55

[1] One pint of milk may be called one pound.
[2] Basis of 4.5% sugar and 2.8% protein.

Whatever the finished product is called, it is watered butter, as a comparison of the composition and food value of the finished product with the original shows. As to the commercial value of the product, if it is worth the combined value of the ingredients, 62 cents, then the cost to the consumer per 100 calories is practically the same as in the original butter, 1.6 cents; if it is worth $1.10, then the consumer pays nearly twice as much; viz., 2.9 cents per 100 calories. The two pounds of mixture will "go as far" as two pounds of butter in the same sense that a pint of milk diluted with a pint of water will go as far as a quart of milk. The same economy will be effected by drinking the pint of milk and serving half portions of butter. This device may be looked upon as an ingenious method for serving half portions.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 202 JANUARY, 1918

ECONOMY IN FEEDING THE FAMILY

IV

An Experience in Keeping Poultry in the City.

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

NOTE BY THE DIRECTOR

The following pages give the experience of one of the Station staff in keeping a small number of fowls for more than a year near the center of New Haven.

In connection with the movement now undertaken to encourage families living in cities and large towns to keep very small flocks for their own supply of eggs and poultry, I believe the results of such an experience where the expense and income have been carefully recorded will be of value to many, however different their particular surroundings may be.

This paper is published in the hope that it may aid in this movement for increased food production.

E. H. JENKINS, *Director.*

Poultry Keeping in the City.

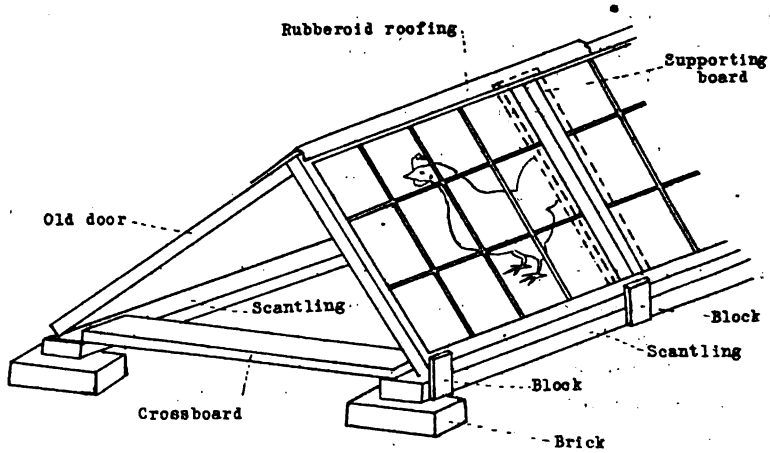
Persons living in cities and large towns have been urged to devote their gardens to the production of food and many have responded to this call by cultivating their backyards. More or less success has attended these efforts, but in many cases the outcome has been distinctly disappointing because sufficient sunshine is rarely available. Under such circumstances no amount of skill or care will avail, because, the sun being the source of all the energy which food supplies, seeds and tubers, which form the substantial elements of our food cannot be produced without its aid. In all partly shaded places the crops are largely leaves which have but little food value.

Gardens where sunshine does not prevail throughout the greater part of the day will yield far better returns if poultry is raised and hens kept for eggs, and in this time when all waste of food should be avoided there is no better way of recovering the last scrap of table refuse than by feeding it to chickens. Every particle of meat left on bones from chops, steaks, etc., even if these first go through the soup kettle can thus be utilized, as well as all of the residues of vegetables of all kinds which are unsuitable for human consumption. Food of this kind is exactly what poultry need to supplement their grain rations.

I live in the center of New Haven and last year tried the dual experiment of keeping hens for eggs and raising young chicks, and in order to learn what the return from this form of backyard agriculture might be I kept an accurate account of expenses and returns. Although I had had no experience with poultry I found it distinctly profitable, for not only did I get a good supply of absolutely fresh eggs, but also fowls, roasters and broilers which in quality were equal to the very best that could be bought.

To make such an undertaking pay the first thing to be considered is overhead charges. A few birds cannot meet heavy expenses of this kind. The high board fences on two sides of my garden and a building on a third side made it necessary to buy only enough wire netting to fence in the fourth side. In this way a yard about forty feet square was provided. The building on one side of this

was an old brick barn in one corner of which was a box stall about ten feet square. By cutting a hole through the barn wall on the east side an exit to the hen yard was provided. This opened into a covered runway. For the north side of this runway three old doors that happened to be on hand were used. These were tilted over against a row of old window sash that met them tent-fashion and admitted all the south sun to the runway, the sash being nearly at right angles to the sun's rays. As support for the doors and sashes, pieces of scantling were laid on bricks resting on the ground, the scantling being kept in place by narrow cross boards nailed from one to the other. To make this intelligible the following sketch must be referred to:



Before putting the sashes in place the doors were supported at the proper angle by boards about six inches wide which were nailed to the scantling at the lower end and to the door at the upper end. These boards were so placed that the ends of adjacent sashes rested on them when in place and in this way rain was prevented from running into the cracks between the sashes.

To keep water out at the peak where the sashes rest against the doors, a strip of heavy roofing material was nailed to the doors but not to the sashes. In this way a perfectly tight runway was made at small expense with the sashes unfastened so that they can easily be removed in warm weather. By filling in with earth over the cross boards the ground level inside was raised above that outside and thus kept dry all winter. Owing to the small

space inside this runway a great deal of heat is accumulated in sunny days even in very cold weather, the thermometer on sunny days reaching 80°—100° when the temperature outside is much below freezing. As the earth inside never freezes to any noticeable extent and is always dry the hens dust themselves there all winter. I built this runway or sun parlor in one afternoon. It is about 20 feet long and gives plenty of room for over 30 hens. Of course such a sun parlor can be made of other materials, but probably old doors are as cheap as anything else, for they are tight and require no labor in fitting if all are of the same width. In winter the end of the sun parlor away from the hen house serves as the entrance and thereby draughts in the house are reduced to a minimum. In my old barn I found doors and sashes, as well as all necessary boards and scantling and as the box stall was ready at hand, quarters for my hens cost me only $2.50 which I had to pay for the 40 feet of poultry netting and $1.90 which I paid for the heavy roofing paper and some tar paper which was used to cover the floor of the house.

Not everyone would find so much of the needed materials about his place but with ingenuity similar quarters could probably be provided at small expense. One must be sure to remember that the cost of quarters must be kept small, for it takes a good many eggs even at the present high prices to pay for new boards and skilled carpenters. A large part of the return from the backyard agriculture comes from the chance it gives to a busy man to occupy his mind and leisure moments and to apply his ingenuity and business skill in a field wholly different from his daily routine. I can recommend it to anyone who has a taste for farm life and no other opportunity to gratify it. The labor involved is small but has the disadvantage of being constant. I solved this problem by giving one-quarter of the produce to a young man who lives nearby and seems satisfied with the arrangement and much interested in the experiment.

Just a year ago this venture was initiated by the purchase of twelve Rhode Island Red pullets on December 4th.* These proved to be what the seller represented them to be for they at once began to lay, and on December 7th twelve more were bought from

* Roosters should never be kept in town for they are noisy and have no effect on egg production; furthermore, infertile eggs keep better than fertile ones.

the same party. Being a novice in the business and not having time to spend in an attempt to buy at the lowest price, these cost me $48. Laying well through the winter and spring these hens gradually became broody. After setting three of them with poor success and trying to break up others, it seemed more profitable to kill and eat them as young fowls. Four were kept through the fall to see what they would return in the way of eggs, but up to the present time have laid only sixteen eggs. Under backyard conditions it seems decidedly more profitable to eat the hens as soon as they cease laying; otherwise they "eat their heads off" and, besides, the longer they are kept the greater the loss by death which, under backyard conditions, has been my greatest cause of loss of profit. Poultry should be either growing or laying eggs all of the time, otherwise they will not earn their living. Probably on the farm it pays to keep hens through the second and third year, but under city conditions this is evidently not the case. Owing to the diminishing size of the flock the egg production fell off during the summer, but at this season fresh eggs are relatively cheap. In August 24 White Leghorn pullets, hatched in February and raised at Storrs, were added to the flock in the hope that these might lay during the fall and winter.

The egg production was as follows:

	Number of hens at the end of each month.		Number of eggs.	Value.
1916, December	24		134	$8.30
1917, January	24		106	5.85
February	24		188	9.40
March	23		289	10.80
April	22		312	11.70
May	16		201	9.18
June	12		217	9.90
July	4		159	7.32
August	4 Rhode Island Reds	42	82	3.25*
	24 White Leghorns	40		
September	4 Rhode Island Reds	7	170	8.00*
	24 White Leghorns	163		
October	4 Rhode Island Reds	3	129	9.00
	23 White Leghorns	126		
November	4 Rhode Island Reds	0	136	9.62
	22 White Leghorns	136		
December	4 Rhode Island Reds	6	190	12.67
	20 White Leghorns	184		
			2,313	$114.99

* Part of these pullets' eggs were too small to be marketable, and allowance was made therefor in estimating their value.

A financial statement of this experience in poultry keeping follows:

STATEMENT OF RECEIPTS AND EXPENSES.

Receipts:			
* Eggs (2,313).....	$114.99		
Meat:			
14 fowls... $24.50			
6 broilers.. 7.12			
2 roasters.. 4.00			
	35.62		
		$150.61	
Expenses (excluding Labor):			
Equipment:			
Tar paper..... $1.15			
Roofing paper... .75			
Poultry netting.. 7.41			
	$9.31		
Birds bought.....	84.00		
*Feed bought.....	57.40		
			150.71
On hand:			
Birds:			
20 White Leghorn pullets @ $1.75..	$35.00		
6 R. I. Red pullets @ 1.50..	9.00		
4 R. I. Red hens @ 1.50..	6.00		
2 Plymouth Rock pullets @ 1.50..	3.00		
1 Plymouth Rock cockerel @ 2.00..	2.00		
	$55.00		
Feed.....	4.50		
		59.50	
Gain.....			59.40
		$210.11	$210.11

* Per lists.

The value set on these eggs will seem high to a farmer, but this was estimated on the basis of the cost of strictly fresh eggs delivered at my house and is what it would have cost me to buy them. Up to this time six of the Rhode Island Reds have died and three have been very sick from canker. These last were cured by vigorous treatment with tincture of iodine. Of the White Leghorns four died. The causes of death were not ascertained with certainty, but two of the Leghorns apparently were "egg-bound."

This is a high death rate, but in a city is probably to be expected, as the sparrows and starlings that abound in towns may easily transfer infection from one place to another. I have succeeded in securing some return from these pests by trapping and feeding them to the chickens. Both sparrows and starlings were eaten with avidity. If back yard poultry raising is to become profitable, every bird that shows any sign of illness should be either quarantined or killed. I have a small quarantine coop and yard for this purpose and very lately by immediately isolating five pullets I prevented what appeared to be roup from spreading and saved all my infected birds.

During the late spring three hens were set on Rhode Island Red eggs, but the hatchings were poor as only eighteen chicks were obtained. All of these lived and grew vigorously. They were kept separate from the laying hens by fencing off a part of the lawn with poultry netting kept in place by dahlia stakes driven into the ground. A gate was hinged to a tree on one side and to a post firmly set on the other. In this way no injury was done to the lawn and the poultry netting and gate were later removed in a few minutes. A great many people living in cities have ideal places of this kind for raising young chicks, for trees and shrubs afford the shade they need and where there is not enough sunshine for a successful garden there is plenty of sun for chicks. Of the eighteen chicks thus raised nine were cockerels. Of these latter six were killed for broilers when three months old. As they had grown at the maximum rate they weighed nearly three pounds each when dressed and although large for broiling they were excellent when thus cooked, far superior to the ordinary under-fed farm chicken usually sold in the markets. Two of the remaining cockerels were killed when about five months old and weighed almost six pounds each, dressed. These made as fine roasting chickens as were ever eaten. The secret of success in raising such birds for the table is to give them plenty of food, both dry mash and scratch feed, as well as all the waste soup meat and similar refuse from the kitchen. They should also have plenty of lawn to range over for chickens need much grass and other fibrous vegetable food if they are to remain healthy and grow fast. The faster they grow the cheaper and better their meat. As grass usually grows fast in summer, a lawn furnishes a large amount of this kind of food without suffering damage. For the table only the large

varieties of chickens should be raised, such as Rhode Island Reds, Plymouth Rocks, White Wyandottes, etc. The hens of all these breeds are good layers and the pullets should be kept for this purpose.

Now as to the costs excluding labor:

Dec.	7, 1916,	100 lbs. corn	$2.35
		10 lbs. oyster shells	.10
		grit	.60
Feb.	1, 1917.	100 lbs. corn	2.35
		25 lbs. oyster shells	.25
March	31,	100 lbs. corn	2.55
April	20,	3 sittings eggs	1.50
May	11,	50 lbs. chick food	2.10
	20,	100 lbs. corn	3.00
June	10,	200 lbs. corn	6.00
	13,	grit	.15
		oyster shells	.10
	18,	50 lbs. chick food	2.15
July	1,	50 lbs. chick food	2.20
	20,	50 lbs. chick food	2.00
	"	50 lbs. scratch feed	2.00
		insect powder	.15
Aug.	15,	100 lbs. scratch feed	4.40
Oct.	10,	50 lbs. scratch feed	2.30
Nov.	1,	25 lbs. scratch feed	1.20
	8,	100 lbs. scratch feed	4.30
		100 lbs. mash	3.60
		25 lbs. meat scrap	1.25
Dec.	8,	100 lbs. scratch feed	4.30
		100 lbs. wheat	4.50
		1 bale oat straw	2.00
			$57.40

As no charge has been made for labor and as the equipment cost less than $10, because so much old material was used, the financial results of this experiment are not very inviting to one who views the problem of backyard poultry farming from a purely financial standpoint. Viewed from the point of food production, however, the results of these efforts are in my opinion far greater than from backyard vegetable gardening, for I have also tried

that with much greater success than most of my friends have had, largely owing to exceptional conditions.

This is the experience of a greenhorn and doubtless some other greenhorn might have better luck, but however that may be I produced a good deal of real food at a considerable profit per hen. In an undertaking of this sort one must count his reward for the labor involved as consisting in a pleasant out-door occupation and the satisfaction that his pleasure has resulted in an increase in the food supply instead of a decrease, as results from most other forms of amusement.

The experience gained in this experiment has convinced me that by raising young chicks in backyards by those who have grounds with sufficiently extensive lawns a relatively large amount of food can be produced and that this is the most productive use that can be made of such places. Many people have lawns shaded with trees and shrubbery which they do not wish to destroy by converting them into vegetable gardens. Furthermore, such places are usually so shaded that seed, fertilizer and labor are wasted and no useful purpose is served by planting. These back lawns are ideal places for young chicks and the younger members of the family can find no more useful occupation than in caring for them. It surprised me to find how chickens throve on my back lawn and how well the lawn appeared after they were removed in the fall. Next summer I shall try to raise at least 100 chicks on my lawn.

I would buy good vigorous incubator chicks instead of raising them under a hen, if I did not fear that cats and rats would destroy them unless watched and protected by a mother hen. In any event I shall give each hen as many chicks as she can cover and if necessary I shall buy some hens with broods early in the season and reinforce these broods with incubator chicks.

Where the premises are restricted in area and do not include lawns of considerable size it would be inadvisable to undertake the rearing of chicks. Under such conditions efforts should be limited to egg production.

SEVENTEENTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1917

(Being Bulletin 203, Connecticut Agricultural Experiment Station)

BY

W. E. BRITTON, PH.D.

State Entomologist

NEW HAVEN, CONN.

1918

CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

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Vegetable Growing.	W. C. PELTON, B.S.

* Died January 10, 1918.
† Absent on leave, In U. S. Service.

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BULLETIN 203

SEVENTEENTH REPORT

OF THE

State Entomologist of Connecticut

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I have the honor to submit the following pages as my seventeenth report as State Entomologist of Connecticut for the fiscal year ending September 30, 1917. This report contains brief accounts of the various lines of inspection and control work placed under the State Entomologist by legislative enactment; the chief entomological features of the season; and several special articles dealing with injurious insects which embody the results of study and observation by members of the staff.

Respectfully submitted,
W. E. BRITTON,
State Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST FROM OCTOBER 1ST, 1916, TO SEPTEMBER 30TH, 1917.

RECEIPTS.

From E. H. Jenkins, Treasurer	$4,000.00	
Account of 1916, Balance	974.10	
State Comptroller, Apiary Inspection Account	10.50	
" " Gipsy Moth Control Account	434.00	
		$5,418.60

EXPENDITURES.

For Field, Office and Laboratory Assistance:		
B. H. Walden, salary	$875.00	
Q. S. Lowry, "	1,141.62	
M. P. Zappe, "	1,083.31	
J. S. Miller, "	72.00	
J. K. Lewis, "	21.00	
Alice C. Heath, "	277.42	
Grace A. Foote, "	397.75	
Other stenographic work	2.00	
		$3,870.10

EXPENDITURES (*Continued.*)	$3,870.10	
Printing and Illustrations	14.10	
Postage	56.82	
Stationery	16.78	
Telegraph and Telephone	9.54	
Office Supplies	102.20	
Library	40.43	
Laboratory Supplies	49.74	
Express, Freight and Cartage	3.45	
Tools and Supplies	83.68	
Travelling Expenses	185.05	
Balance, cash on hand	986.71	
		$5,418.60

Memorandum:—This account of the State Entomologist has been audited by the State Auditors of Public Accounts. The items of $10.50 and $434.00 credited above as received from the State Comptroller are transfers from other appropriations to cover time expended on work for which such appropriations were made.

SUMMARY OF INSPECTION AND OFFICE WORK.

325 samples of insects received for identification.
86 nurseries inspected.
86 regular certificates granted.
40 parcels of nursery stock inspected and certified.
49 orchards and gardens examined.
163 shipments, containing 682 cases, 1,706,977 plants imported nursery stock inspected.
45 shipments, or 28 per cent. found infested with insects or fungi.
473 apiaries, containing 4,506 colonies, inspected.
79 apiaries, containing 219 colonies, found infested with European foul brood.
2 apiaries, containing 8 colonies, found infested with American foul brood.
7 apiaries, containing 9 colonies, found infested with pickled or sac-brood.
2026 letters written on official work.
435 post cards written on official work.
171 reports of inspection to Federal Horticultural Board.
890 bulletins, etc., mailed on request or to answer inquiries.
84 packages sent by mail or express.
30 lectures and addresses made at institutes, granges, etc.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT, 1917.

By W. E. Britton:

Sixteenth Report of the State Entomologist (Part II of Station Report for 1916); 82 pages, 3 figures, xvi plates; 10,000 copies distributed in April.

Report of Committee on Injurious Insects, Proceedings Connecticut Pomological Society, page 20. (3½ pages) 1917.

Report of Committee on Injurious Insects, Proceedings Connecticut Vegetable Growers' Association, page 17 (2 pages) 1917.

Recent Anti-Mosquito Work in Connecticut (2 pages), Journal of Economic Entomology, Vol. 10, page 109, 1917.

Bulletin 195, Insects Injuring Stored Food Products in Connecticut, 21 pages, 18 figures; 10,500 copies distributed in August.

Mosquito Control Work in Connecticut in 1916. Proceedings Fourth Annual Meeting of the New Jersey Mosquito Extermination Association, page 184 (6 pages) 1917.

By B. H. Walden:

Simple Apparatus for Insect Photography. (6 pages, 1 plate) Journal of Economic Entomology, Vol. 10, page 25, 1917.

By Quincy S. Lowry:

An Outbreak of the Eight-Spotted Forester, *Alypia octomaculata*, in New Haven, Conn. (2 pages) Journal of Economic Entomology, Vol 10, page 47, 1917.

By Irving W. Davis:

The Present Status of the Gipsy and Brown-Tail Moths in Connecticut, (2 pages) Journal of Economic Entomology, Vol. 10, page 193, 1917.

By M. P. Zappe:

Egg-Laying Habits of *Diprion simile* Hartig. (2 pages) Journal of Economic Entomology, Vol 10, page 188, 1917.

DEPARTMENT STAFF

W. E. BRITTON, Ph.D. ..... *State and Station Entomologist.*
B. H. WALDEN, B.Agr. ..... *First Assistant.*
QUINCY S. LOWRY, B.Sc. ..... *Assistant.*
MAX P. ZAPPE, B.S. ..... *Assistant.*
IRVING W. DAVIS, B.Sc. ... *Assistant and Deputy in Charge of Moth Work.*
J. T. ASHWORTH ..... *Assistant in Moth Work.*
MISS GRACE A. FOOTE, B.A. ..... *Clerk and Stenographer.*

H. W. COLEY, Westport
A. W. YATES, Hartford } ..... *Apiary Inspectors.*

Messrs. Walden, Lowry, Davis and Zappe have continued as assistants and have all aided in the inspection of nursery stock, as well as in the general work of the department.

Mr. Walden was detailed as deputy to the Director of the Station to look after the mosquito drainage work under the new law,

and was thus occupied throughout the six summer months. Half of his yearly salary will now be paid from the insect pest appropriation and the other half from Station funds, or from the appropriation for mosquito control work. Mr. Walden spent most of his time in the field during the summer but was able to do some of the general photographic work of the department and helped inspect some of the nurseries.

Mr. Lowry has been engaged in the inspection of growing nursery stock, imported nursery stock, and has studied the insects attacking vegetable crops. He conducted experiments at the Station farm at Mt. Carmel in controlling the striped cucumber beetle and other insects attacking cucurbitaceous plants, but on account of an operation for appendicitis was obliged to be in the hospital for about six weeks in May and early June.

Mr. Davis has continued in charge of the work of suppressing the gipsy moth and the brown-tail moth, and has been located at Danielson throughout the year. He has inspected most of the nurseries and some of the imported nursery stock in the eastern portion of the State. On account of an operation, he was unable to aid in the general inspection of the larger nurseries as in former years.

Mr. J. T. Ashworth has been employed since June 1 as assistant to Mr. Davis. Mr. Ashworth also resides in Danielson.

Mr. Zappe has helped inspect nurseries and imported stock, has been in charge of the insectary, and has worked on the collections. He has also collaborated with the entomologist in studying the life history of the European pine sawfly, *Diprion simile*, and in some orchard spraying experiments for the control of the false apple red-bug. Mr. Zappe has also investigated and devised methods of controlling a southern cockroach, *Pycnoscelus surinamensis*, which has caused much damage in the greenhouses of A. N. Pierson, Inc., Cromwell, and the little red ant or Pharaoh's ant, *Monomorium pharaonis*, an annoying pest in a large dwelling house in Hartford.

Miss Foote has done the necessary stenographic and clerical work and has also indexed much literature to facilitate the looking up of references. She has also kept records and made out the reports to the Federal Horticultural Board. From November to April she was called home by sickness and the work was done by Miss Alice C. Heath.

Mr. J. Kirby Lewis was employed for a few days in August, and Mr. J. S. Miller for three weeks in September, to help inspect nurseries.

Messrs. H. W. Coley and A. W. Yates have made the apiary inspections as in preceding years on a *per diem* basis.

All mentioned above who have aided in the work of the department have labored conscientiously and their efforts are duly appreciated.

New Equipment.

No new equipment of importance has been obtained for the office or laboratory during the year. In the gipsy moth work, the Ford car was exchanged for a new one in the spring and a new "Buick four" was purchased early in the summer.

Chief Lines of Work.

As has been the case for several years, the required routine and control work continues to monopolize the time and efforts of the staff. This includes the annual systematic inspection of nurseries, and the inspection of orchards, fields, gardens and greenhouses on request. In co-operation with the Federal Horticultural Board all woody field-grown stock imported into Connecticut from foreign countries has been inspected.

The work of suppressing the gipsy and brown-tail moths is placed in charge of the State Entomologist. This work has been in immediate supervision of Mr. Davis, aided by Mr. Ashworth, though all expenses are paid upon the order of the State Comptroller, on duly receipted, certified and approved vouchers.

The inspection of apiaries is also placed by law upon the office of State Entomologist, though, like the gipsy moth work, the bills are paid from Hartford.

The department has been concerned with the anti-mosquito work, not only around New Haven, but also of the whole state. Mr. Walden has been in immediate charge.

Studies of the European pine sawfly, *Diprion simile*, have been continued and are now about finished and ready for publication.

Means for controlling a pest of cockroaches in greenhouses, and the little red ant or Pharaoh's ant in dwelling houses, have been worked out by Mr. Zappe.

Mr. Zappe and the Entomologist have conducted spraying experiments at Clintonville and at Milford to control apple aphids and apple red-bugs.

The study of insects attacking vegetable crops has been continued by Mr. Lowry, who has prepared the paper published in this report on the Striped Cucumber Beetle. Further work will be done on squash and cucumber insects.

Considerable time was put upon editing, indexing and reading proof of the "Hymenoptera of Connecticut," which was issued in March as Bulletin No. 22 of the Connecticut State Geological and Natural History Survey.

The Entomologist has also prepared, and later revised for publication, A Check List of The Insects of Connecticut, which will be published by the Survey. He has also written a portion, and edited the remainder, of a series of papers on the "Hemiptera of Connecticut," which will be published by the Survey at some time in the future.

The outbreak of the potato aphid was sudden, widespread, and caused much damage. On account of the war and the campaign to plant vegetable gardens in city back yards and on farms, the correspondence of the office, as well as telephone inquiries, required more than the usual attention.

The following pages of this report give in greater detail an account of the work of the department for the year.

INSPECTION OF NURSERIES.

Nursery inspection was commenced on August 6, and finished on October 15, and the work was done by Messrs. Lowry, Zappe, Davis, Walden, J. S. Miller, J. K. Lewis, G. A. Root and Britton. Mr. Root was employed for the summer by the State Forester in suppressing the white pine blister rust, and was detailed to examine the currant bushes and pine trees in the nurseries for this disease. Though it had been found in two nurseries previously, no signs of it occurred in any of them at the time of the annual inspection.

The Ford car was spared from the gipsy moth work from August 11 to October 5 and was used to transport the men. It was especially useful in reaching the larger nurseries and even others which are not adjacent to railroad and trolley lines.

All nurseries were given a thorough inspection, and on the whole were found to be in good condition. All infested trees and shrubs were marked and the owner was informed regarding them and directed to treat or destroy those having pests liable to be distributed on nursery stock.

In 29 nurseries no pests were found. The following pests were found in the number of nurseries indicated: Oyster-shell scale, 44; San Jose scale, 23; scurfy scale, 14; spruce gall aphid, 14; poplar canker, 9; tulip tree scale, 4; pine leaf scale, 3; lilac borer, 3; chestnut blight, 2; imported European pine sawfly, 2; elm scale, 2; *Lina scripta*, 2; pear leaf blister mite, 2; Oak leaf roller, 2; apple borer, ash borer, linden borer, shot hole borer, Abbott's sawfly, juniper web-worm, *Lina japonica*, peach leaf miner, *Lecanium*, pit-making oak scale, rose scale, and West Indian peach scale, 1 each.

Of course, such common insects as aphids, fall web-worm, white-marked tussock moth, *Datana ministra*, red-humped caterpillar and leaf hoppers were found almost everywhere, and are not taken into account except in severe infestations.

In addition to the regular inspections, a number of parcels have been examined and certified. These were to be shipped by persons not in the nursery business, or perhaps the stock was not covered by the regular certificates, and these parcels were refused by the transportation companies unless accompanied by certificates. During the year 40 such parcel certificates were issued.

Two nurseries were inspected twice, in addition to the examinations for pine blister rust, which were made in May and June in the several nurseries having pine trees.

Of the 83 names on the nurserymen's list for 1917, four are new since the publication of the last year's list. Two have dropped the nursery business, three firms have changed names, and two have not yet cleaned up their nurseries so as to receive certificates.

The area devoted to growing nursery stock in Connecticut is about the same as last year, being slightly curtailed on account of the scarcity of labor, and amounts to about 1,500 acres. The list for 1917, together with date and number of certificate, and acreage of each, is given below:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1917.

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Alderson & Dell, The Misses....	Greenwich.....	1	Sept. 29	842
Barnes Bros. Nursery Co.....	Yalesville.....	155	Oct. 5	853
Beattie, Wm. H.....	New Haven.....	1	Oct. 9	864
Bertolf Bros.....	Sound Beach....	25	Oct. 16	871
Bowditch, J. H.....	Pomfret Center..	8	Sept. 12	819
Bradley, H. M.....	Derby.....	1	Dec. 18	895

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1917--*Con.*

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Bradley, Smith T.	New Haven	1	Nov. 22	887
Brainard Nursery & Seed Co.	Thompsonville	6	Oct. 3	850
Braley & Co	Burnside	1	Sept. 26	833
Bretschneider, A.	Danielson	1	Sept. 5	813
Brooks Bros.	Westbrook	2	Oct. 11	867
Burr & Co., C. R.	Manchester	300	Sept. 15	822
Burroughs, Thos. E.	Deep River	3	Sept. 17	824
Chapman, C. B.	Groton	1	Oct. 1	844
Chapman, C. E.	North Stonington	2	Sept. 28	835
Conine Nursery Co., The F. E.	Stratford	50	Oct. 3	849
Conley, L. D.	Ridgefield	3	Sept. 25	830
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	2	Oct. 8	860
Conn. Agri. Experiment Station (W. O. Filley, State Forester)	New Haven	1	Sept. 25	832
Conway, W. B	New Haven	1	Oct. 8	858
Crofut & Knapp Farm	Norwalk	60	Oct. 9	862
Cross Highway Nurseries	Westport	6	Nov. 23	889
Dallas, Inc., Alexander	Waterbury	3	Oct. 25	875
Dowd, Frank C.	Madison	3	Nov. 26	891
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont & New Haven	155	Sept. 15	823
Fairfield Landscape & Nurseries Co.	Cannon Station	5	Nov. 10	881
Gardner's Nurseries	Cromwell	10	Sept. 14	821
Geduldig, G., Estate of	Norwich	1	Oct. 2	847
Goodwin Associates, Inc., The James L.	Hartford	1	Sept. 25	828
Hartford Park Commissioners (G. A. Parker, Supt.)	Hartford	3	Sept. 28	837
Heath & Co., H. S.	Manchester	50	Sept. 7	817
Hilliard, H. J.	Sound View	1	Sept. 28	836
Holcomb, Irving	Simsbury	1	Sept. 12	818
Horan & Son, Jas.	Bridgeport	1	Oct. 3	851
Houston & Sons, J. R.	Mansfield	6	Oct. 8	861
Hoyt's Sons Co., The Stephen	New Canaan	300	Oct. 19	873
Hubbard & Co., Paul M.	Bristol	12	Oct. 20	874
Hunt & Co., W. W.	Hartford	12	Sept. 29	839
Intravaia, Joseph (2)	Middletown	1	Sept. 17	825
Isselee, Charles.	Darien	3	Oct. 3	852
Kelley, James	New Canaan	1	Sept. 7	814
Kellner, Herman H.	Danbury	1	Oct. 2	846
Long, J. A.	East Haven	1	Nov. 26	893
Mallett & Co., G. A.	Bridgeport	1	Nov. 10	882

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1917--*Con.*

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Maplewood Nurseries (T. A. Peabody, Mgr.)	Norwich	1	Oct. 2	848
Marigold Farm (H. Kelley, Prop.)	New Canaan	1	Sept. 7	815
McDermott, E. F	Windsor	1	Sept. 25	829
Meier & Gillette	West Hartford	2	Nov. 26	892
Munro, Charles	New Haven	1	Sept. 29	841
New Haven Nurseries Co.	New Haven	10	Oct. 16	870
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Nov. 12	883
New London Cemetery Association (F. S. Newcomb, Pres.)	New London	2	Oct. 1	845
North-Eastern Forestry Co	Cheshire	20	Sept. 22	826
Norwich Nurseries (O. E. Ryther, Prop.) (2)	Norwich	6	Oct. 30	878
Oakland Nurseries	Manchester	50	Sept. 7	816
Palmer, L. M., Estate of	Stamford	5	Nov. 22	888
Park Gardens	Bridgeport	1	Nov. 7	879
Pequod Nursery Co.	Meriden	15	Oct. 5	855
Phelps, J. Wesson	Bolton	1	Sept. 29	843
Phelps & V. T. Hammer Co., The J. W	Branford	2	Oct. 11	866
Pierson, A. N., Inc	Cromwell	45	Sept. 28	834
Platt Co., The Frank S.	New Haven	1	Nov. 12	884
Pomeroy, Edwin C.	Northville	1	Sept. 25	831
Purington, C. O	Hartford	1	Sept. 25	827
Quality Seed Store	Stamford	1	Oct. 10	865
Raab, Joseph O	Ansonia	1	Oct. 5	856
Reck, Julius	Bridgeport	1	Oct. 13	868
Roehrich, W. G	Stratford	1	Oct. 15	869
Saxe & Floto	Waterbury	1	Nov. 23	890
Scott, J. W	Hartford	5		
Sierman, C. H	Hartford	3	Oct. 25	876
South Wilton Nurseries	South Wilton	5	Sept. 14	820
Steck, Charles A	Bethel	1	Sept. 29	838
Stratfield Nursery Co	Bridgeport	4	Nov. 9	880
Traendly & Schenck	Rowayton	2	Oct. 6	857
Upson, R. E	Marion	3	Nov. 17	886
Verkade, H	New London	1	Nov. 12	885
Vidbourne & Co., J	Hartford	7	Sept. 29	840
Wallace, Arthur T	Wallingford	1	Oct. 16	872
Wallingford Nurseries	Wallingford	10	Oct. 5	854
Wilson & Co., C. E	Manchester	7	Sept. 5	812
Yale University Forest School	New Haven	2	Oct. 9	863
Young, Mrs. Nellie A	Pine Orchard	1	Oct. 30	877
		1,461		

INSPECTION OF IMPORTED NURSERY STOCK.

On account of the war, fewer shipments, cases and plants were received than during 1916, as the following figures show:

Year	Shipments	Cases	Plants
1916	291	2,102	1,998,178
1917	163	682	1,706,977

These shipments have entered the country under the system of permits and notices adopted by the Federal Horticultural Board five years ago, and which is still in force.

Reports have been made to the Board of 171 shipments, 8 of which were not inspected; 3 were refused by consignee, 2 contained seeds, 2 herbaceous stock, and one was destroyed by consignee.

The stock came from about the same countries and in about the same proportions as in 1916, except that from Belgium a larger proportion of shipments was received. Most of the stock grown in Belgium was taken into Holland and shipped from Holland ports. The figures for these shipments are given in in the following table:

SOURCES OF IMPORTED NURSERY STOCK, 1916–1917.

Country	No. of Shipments	No. of Cases
Holland	57	249
Belgium	56	234
France	21	138
Ireland	12	14
England	9	32
Scotland	3	3
Japan	3	9
Ontario	1	2
Bermuda	1	1
Total	163	682

Most of this stock was inspected by Mr. Lowry, but Messrs. Zappe, Davis, Walden and Britton helped. The total time required in making these inspections amounts to 120 days of 7½ hours each, or about two-fifths of the working time of an entire year. The cost of this work, including time and travelling expenses, has amounted to about $663.00, or slightly more than half that of last year, and has been paid on duly accredited vouchers by order of the State Comptroller from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock.

Of the 163 shipments inspected, 45 shipments, or about 28 per cent., were found infested with insects or fungi, some of which are pests. Among others, perhaps one of the most important discoveries was an egg-mass of the European lackey moth, *Malacosoma neustria* Linn., a defoliator of fruit trees, oak, elm, rose, poplar, hawthorn and hornbeam.* Had these eggs not been intercepted, they might have hatched and started a colony of the lackey moth in this country.

Some of the insects were identified here, and some of the fungi were determined by Dr. G. P. Clinton, Botanist of this Station. The other insects and fungi were identified by specialists in the Bureaus of Entomology and Plant Industry of the U. S. Department of Agriculture, Washington, D. C.

The information regarding these infestations occurs in the following list:

PLANT DISEASES AND INSECTS ON IMPORTED NURSERY STOCK, 1916–17.

45 Shipments infested.

Plant Diseases.

Exobasidium vaccinii on Azalea. (29 shipments.)

Bier & Ankersmit, Melle, Belgium; G. J. Bier, Nieuwerkerk, Holland; M. Debaerdemaeker, Everghem, Belgium (3); DeCoster Bros., Melle, Belgium; Achille de Coster, Melle, Belgium (2); Arthur de Meyer, Mont St. Amand, Ghent, Belgium (2); August de Vreese, Loochristy, Belgium (4); Guldemond & Son, Lisse, Holland; K. J. Kuyk, Ltd., Ghent, Belgium (4); Van Dillewyn & Thiel, Meirelbeke, Belgium (7); Van Gelderen & Co., Loochristy, Belgium (2); A. Van Schoote, Ghent, Belgium.

Pseudomonas tumifaciens Crown Gall.

On Pear. Franco-American Seedling Co., Ussy, France.

On Lilac. F. Delaunay, Angers, France.

On Rose. F. Delaunay, Angers, France; W. Fromow & Sons, Windlesham, Surrey, England; Vincent Lebreton's Nursery, La Pyramide-Trelaze, France.

Acremoniella atra (a saphrophyte) on Rhododendron. Hugo T. Hooftman, Boskoop, Holland.

Macrosporium sp. (a saphrophyte) on Rhododendron. Hugo T. Hooftman, Boskoop, Holland.

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* W. D. Pierce. A Manual of Dangerous Insects Likely to be Introduced in the United States through Importations. U. S. Dept. of Agr. p. 106, 1917.

Pestalozzia guepini on Rhododendron.
Harry Koolbergen, Boskoop, Holland; Schaum & Van Tol, Boskoop, Holland.
Phyllosticta sp. on Rhododendron. Harry Koolbergen, Boskoop, Holland.
Glomerella cingulata on Palm. K. J. Kuyk, Ltd., Ghent, Belgium (2).
Ascomycete on Oak, Immature. Franco-American Seedling Co., Angers, France.

Insects.

Scale, Oyster Shell, on *Buxus*.
Jac. Smits & Co., Naarden, Holland; J. Verkade & Sons, Boskoop, Holland.
Emphytus cinctus on Manetti stock.
E. Bruzeau, Orleans, France; F. Delaunay, Angers, France; Franco-American Seedling Co., Angers, France; Franco-American Seedling Co., Ussy, France (2); Vincent Lebreton's Nursery, La Pyramide-Trelaze, France.
Aleyrodes Sp. on Azalea. M. Debaerdemaeker, Everghem, Belgium.
Aphis, Woolly, on Apple Roots. Franco-American Seedling Co., Ussy, France.
Malacosoma neustria, Egg mass. K. Rosbergen & Son, Boskoop, Holland.
Acronycta rumicis. F. Delaunay, Angers, France.
Acronycta rumicis. Cocoons. Vincent Lebreton's Nursery, La Pyramide-Trelaze, France.
Empty Dipterous Pupae on Azaleas. W. C. Hage & Co., Boskoop, Holland.
Empty Sawfly Cocoon. M. Debaerdemaeker, Everghem, Belgium.
Lepidopterous larva in packing material. J. Blaauw & Co., Boskoop, Holland.
Leaf Miner, Work in Holly. Jac. Smits & Co., Naarden, Holland.

INSPECTION OF APIARIES.

This work has been done in about the same manner as in former years, Mr. H. W. Coley of Westport covering Fairfield, New Haven, Middlesex and New London counties, and Mr. A. W. Yates of Hartford covering Litchfield, Hartford, Tolland and Windham Counties. Each inspector has been paid by the day and expenses for the time worked, from the appropriation made by the legislature for this purpose.

In 1917, 473 apiaries were inspected as against 467 in 1916, and though nearly all expenses have increased, the costs per apiary and per colony are slightly less than last year. Eighty-four towns were visited as against 96 last year. In 1917 apiaries were inspected in the following 18 towns where no inspections were made in 1916: Branford, North Branford, Durham,

Middletown, Portland, Kent, New Hartford, Plymouth, Roxbury, Thomaston, Watertown, Woodbury, Burlington, Canton, New Britain, Newington, Sterling and Woodstock.

European foul brood was found in each county in the state and in the following 37 towns: Bethel, Fairfield, Huntington, New Canaan, Norwalk, Ridgefield, Stamford, Weston, Westport, Ansonia, Madison, Middlebury, Naugatuck, Waterbury, Wolcott, Durham, Lisbon, Montville, New London, Norwich, Waterford, New Milford, Plymouth, Bloomfield, Bristol, East Windsor, Farmington, Manchester, New Britain, Plainville, Southington, Coventry, Plainfield, Pomfret, Putnam, Sterling and Windham. The percentage of apiaries and colonies infested was considerably lower than in 1916. American foul brood was found only in the town of Old Lyme in New London County. Of the 473 apiaries containing 4,506 colonies examined, 90 apiaries containing 241 colonies, or about 19 per cent., were found diseased.

The statistics of the apiaries inspected in each of the 84 towns in each of the eight counties may be found in the following tables, the summary occurring on page 245:

APIARIES INSPECTED, 1917.

	No. Apiaries			No. Colonies	
	Inspected	Diseased*	Quarantined	Inspected	Diseased*
FAIRFIELD COUNTY.					
Bethel	5	1	0	29	2
Bridgeport	1	0	0	5	0
Danbury	1	0	0	6	0
Darien	2	0	0	59	0
Easton	3	0	0	105	0
Fairfield	8	2	0	160	2
Greenwich	5	0	0	44	0
Huntington	4	2	1	99	3
New Canaan	3	1	0	35	6
Norwalk	7	1	0	60	1
Redding	6	0	0	51	0
Ridgefield	3	1	0	16	1
Stamford	14	2§	0	164	2§
Stratford	4	0	0	113	0
Trumbull	1	0	0	68	0
Weston	5	1	0	30	1
Westport	8	1	0	97	1
Wilton	9	0	0	164	0
	89	12	1	1305	19

* European foul brood unless otherwise indicated.

§ One with European foul brood and one with sacbrood.

New Haven County.					
Ansonia	1	1	0	14	1
Beacon Falls	1	0	0	12	0
Branford	1	0	0	4	0
Cheshire	8	1‡	0	79	2‡
Derby	5	1‡	0	89	1‡
Guilford	2	0	0	9	0
Hamden	2	0	0	13	0
Madison	3	1	0	46	4
Meriden	15	2‡	0	141	3‡
Middlebury	1	1	0	40	6
Milford	5	0	0	58	0
Naugatuck	6	3	0	42	11
North Branford	1	0	0	5	0
North Haven	4	0	0	104	0
Prospect	10	0	0	98	0
Seymour	1	0	0	18	0
Waterbury	10	5	5	58	32
Wolcott	1	1	0	9	3
	77	16	5	839	63
Middlesex County.					
Durham	2	1	0	71	10
Middletown	2	2¶	0	14	5¶
Portland	1	0	0	52	0
	5	3	0	137	15
New London County.					
Lisbon	2	1	0	5	1
Montville	9	4	0	52	6
New London	1	1	0	14	4
Norwich	7	3	0	164	3
Old Lyme	2	2†	0	57	8†
Waterford	2	1	1	63	21
	23	12	1	355	43
Litchfield County.					
Kent	5	0	0	63	0
New Hartford	1	0	0	32	0
New Milford	18	5	0	90	12
Plymouth	3	1	0	20	1
Roxbury	1	0	0	13	0
Thomaston	14	0	0	43	0
Watertown	7	0	0	63	0
Woodbury	1	0	0	27	0
	50	6	0	351	13

† American foul brood.
‡ Sacbrood.
¶ Bee paralysis.

HARTFORD COUNTY.					
Berlin	16	0	0	104	0
Bloomfield	11	3	0	207	6
Bristol	7	3	0	55	4
Burlington	4	0	0	26	0
Canton	7	0	0	21	0
East Hartford	3	0	0	42	0
East Windsor	16	3	0	113	13
Farmington	27	8	0	119	18
Glastonbury	17	0	0	90	0
Hartford	4	0	0	18	0
Manchester	13	8‖	0	93	12‖
New Britain	13	2	0	116	12
Newington	1	0	0	2	0
Plainville	7	2	2	28	5
Southington	5	2	0	33	4
South Windsor	3	0	0	20	0
West Hartford	2	0	0	26	0
	156	31	2	1113	74
TOLLAND COUNTY.					
Andover	2	0	0	7	0
Bolton	2	0	0	4	0
Coventry	6	1	0	50	1
Ellington	10	0	0	60	0
Mansfield	4	0	0	50	0
Vernon	4	0	0	57	0
	28	1	0	228	1
WINDHAM COUNTY.					
Brooklyn	3	0	0	20	0
Killingly	4	0	0	21	0
Plainfield	5	1	0	19	1
Pomfret	9	1	0	47	1
Putnam	5	1	0	13	1
Sterling	15	4	0	15	4
Windham	3	2	0	16	6
Woodstock	1	0	0	27	0
	45	9	0	178	13

SUMMARY OF APIARY INSPECTION.

County	No. Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased
Fairfield	18	89	12	1,305	19
New Haven	18	77	16	839	63
Middlesex	3	5	3	137	15
New London	6	23	12	355	43
Litchfield	8	50	6	351	13

‖ Two with sacbrood; others European foul brood.

SUMMARY OF APIARY INSPECTION—*Continued.*

County	No. Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased
Hartford	17	156	31	1,113	74
Tolland	6	28	1	228	1
Windham	8	45	9	178	13
	84	473	90	4,506	241

	Apiaries	Colonies
Number inspected	473	4506
Infested European foul brood	79	219
Per cent. infested	16.7	4.86
Infested American foul brood	2	8
Per cent. infested	.42	.17
Pickled or sacbrood	7	9
Bee paralysis	2	5
Average number of colonies per apiary		9.52
Cost of inspection		$749.51
Average cost per apiary		1.58
Average cost per colony		.166

European foul brood was reported by Dr. Phillips from Wethersfield and Thompson.

SUPPRESSION WORK AGAINST THE GIPSY AND BROWN-TAIL MOTHS.

By W. E. Britton and Irving W. Davis.

The work against these two pests has been conducted as in preceding years. Mr. Davis has had supervision of the field work under the State Entomologist, and since June 1, 1917, has been assisted by Mr. John T. Ashworth, who has had much experience in this work, being formerly employed by the Gipsy Moth Commission of Massachusetts, and more recently by the Bureau of Entomology of the U. S. Department of Agriculture.

The scouts and other employees necessary have been hired as needed. Some of the scouts have worked for us for several seasons, and have also been employed by the Federal Bureau of Entomology. Others have taken up the work more recently and have received their training by working with the other men in the scouting crews. The force has been impaired, and the work interrupted by men accepting other positions or entering the military service of their country. It is very difficult at present to obtain any kind of help, and much more so the character and type of men who develop into good scouts.

In all of this work the most cordial co-operation has existed between this office and the Federal Bureau of Entomology, and we wish especially to express our thanks to Messrs. A. F. Burgess and L. H. Worthley, who have been in charge of the work for the Bureau.

For the control of the brown-tail moth we have continued clipping off and destroying the winter nests; for suppressing the gipsy moth, the work has consisted of scouting and creosoting egg-clusters, spraying badly infested areas, and banding and destroying caterpillars in and around the colonies or infestations.

New Equipment.

But little new equipment was purchased during the past year. The Ford touring car was turned in toward a new one in the first part of the spring and this has been used by Mr. Ashworth in his work. It is not proving as good as the older model. A four-cylinder Buick touring car was also purchased and has been used by Mr. Davis. As the territory grows, more money and time are saved by the use of automobiles, for many of the towns, such as Ashford and Voluntown, are miles from a railroad.

Employees Who Have Entered Military Service.

The following men have enlisted in the Army or Navy:
Sergt. George D. Stone, Battery D, 56th Mobile Artillery.
Adolph D. Jarvais, Battery D, 56th Mobile Artillery.
William Lord, U. S. Naval Reserve.
George Benoit, Medical Corps.
Clifford A. Ladd, U. S. Navy.
W. Floyd Logee, U. S. Navy.
Charles A. Burdick, 174th Aero Squadron.
James A. Knight, Depot Brigade, Camp Devens.

Brown-Tail Moth Work.

Though this insect now covers the eastern half of the State, it has not spread appreciably during the last two years. In fact, it is difficult to find webs in most of the area supposed to be infested. Last season the webs were so scarce, even in towns which had formerly been heavily infested, that it was not thought necessary to notify these towns to remove and destroy the webs

as was done in 1916. Some scouting was done, however. Men were sent to examine the towns just west of the quarantined area, but no new towns were found infested. Small colonies were located within the quarantined area at New London and Stonington and the webs were removed and destroyed. A few webs were gathered in Canterbury, Bozrah and Preston for Mr. Burgess to use in his parasite work, but even here they were so scarce that the desired number could not be obtained.

Our men were on the watch for adults around lights in various cities and villages in July, but none were observed.

Gipsy Moth Work.

The gipsy moth situation presents an entirely different aspect, however, as there were a large number of single egg-cluster infestations ("singles") throughout the towns in the northeastern corner of the State. This would indicate another but shorter windspread than that of 1913.

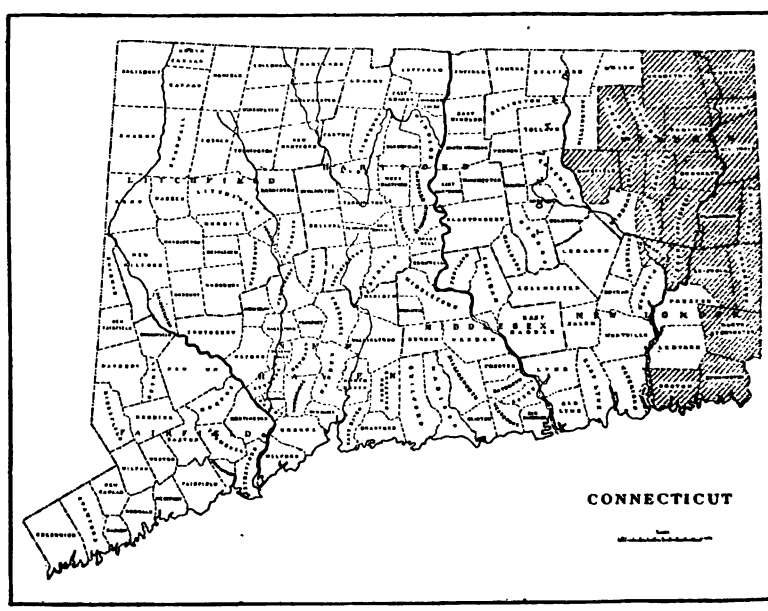

Figure 1. Map of Connecticut, shaded portion showing area now infested by the gipsy moth.

Further south and west an increase was also noted, as in Canterbury, Brooklyn, Hampton and Eastford, while Ashford showed a small decrease. Mansfield for the first time appears in the list of infested towns, two infestations being found near the eastern border of the town. This is the first time the gipsy moth has been taken in Tolland County. The area now infested is shown in figure 1.

Since our funds were limited and some of the towns had shown but few if any infestations in the past few years, it was thought best to scout only restricted portions of certain towns, as in the case of Sterling, Plainfield, Griswold, North Stonington, Stonington, etc. Three of the towns; namely, Sprague, Lisbon and Groton, were not scouted at all. We have planned to scout the entire infested area this coming winter.

The spraying was done with the horse-drawn power sprayer owned by the State and a power-truck sprayer which was lent to us by the Government. The former was used in Thompson, Putnam and Killingly where the infestations were the heaviest and near together. The Government sprayer was used in towns where the infestations were scattering and we were thus able to spray colonies in North Stonington, Canterbury, Hampton and Eastford. Altogether 91 separate infestations were sprayed.

With so many single infestations, it was impossible to band trees near all of them, and therefore only the larger colonies were thus treated. Every effort was made to visit all of the infested localities during the caterpillar season, and in this manner over 37,000 of the gipsy moth larvae were killed, besides those caught in the bands or poisoned by the spraying.

The food plants of the gipsy moth are very numerous but those most favored are apple, oak, willow and alder, while such trees as ash and the evergreens are seldom attacked. In Connecticut the woodland in the infested area consists largely of the various species of oak, with but few evergreens, and this section therefore offers an excellent chance for the spread of this pest.

Parasites.

There are several native insects and some birds that feed on the gipsy moth, but these are not able to control the pest. In 1905 the United States Department of Agriculture introduced from Europe and Japan a number of parasites, some of which

have become well established in this country. The most important of these are the Calosoma beetle (*Calosoma sycophanta* Linn), a tachinid fly (*Compsilura concinnata* Meig.), and several small wasp-like insects (*Apanteles lacteicolor* Vier., *Schedius kuvanae* How., *Anastatus bifasciatus* Fonsc.). All of these mentioned have been colonized in Connecticut with the exception of *Schedius*, an egg parasite. These are, of course, very scarce in this State at the present time, and until they become more plentiful the artificial methods of control will have to be employed.

Some gipsy moth pupae collected in Canterbury in November, 1917, were infested with a white mold or fungus, which has been identified by Mr. A. T. Speare, Bureau of Entomology, as *Isaria farinosa* (Dicks) Fr., a species previously recorded from Massachusetts on gipsy moth pupae.

Present Status of Parasite Work in Connecticut.

The following tabulated information regarding parasites introduced into, and recovered from Connecticut, has kindly been furnished by Mr. A. F. Burgess:

Compsilura concinnata Meig.

Colonized:	1912	1913	1914	1916	1917
	Putnam	Hartford	Plainfield	Suffield	Scotland
			Mansfield	Stafford	Hampton
			Stonington	Colchester	
				Norwich	
				Old Lyme	
Recovered:			1915	1916	1917
			Woodstock	Stonington	Putnam
					Plainfield
					No. Stonington

Zygobothria nidicola Towns.

This species has never been colonized in Connecticut, but in 1917 was recovered from Canterbury and Waterford.

Apanteles lacteicolor Vier.

	1912	1913	1915	1916	1917
Colonized:	Putnam	Suffield	Manchester	East Lyme	Montville
		Hartford	Chester	Canterbury	Groton
		Mansfield	Lebanon		
		Norwich			
		Stonington			
		Griswold			
		Plainfield			
		Killingly			
		Hampton			

	1913	1914	1915	1916	1917
Recovered:	Thompson	Waterford	Stonington	Killingly	Canterbury
	Woodstock	Hartford	Lebanon	Brooklyn	
	Pomfret		Suffield	East Hartford	
	Stafford			Wethersfield	
	Somers				

Meteorus versicolor Wesm.

	1916	1917
Colonized:	Colchester	Lyme
	Waterford	
	Ledyard	

	1914*	1916
Recovered:	Hartford	Woodstock
		Thompson
		Killingly
		Brooklyn

Anastatus bifasciatus Fonsc.

Colonized: 1917

Town	Number of Colonies
Thompson	21
Woodstock	5
Putnam	3
Killingly	6
Pomfret	3
Eastford	2
Brooklyn	3
Hampton	5
Chaplin	1
Mansfield	1
Canterbury	1
Total	51

*Note: It is probable that many of the earlier colonies of *A. lacteicolor* also contained a few cocoons of *M. versicolor*.

Each of these colonies contained 1,000 parasites, making a total of 51,000 parasites of this species liberated in Connecticut in 1917. Collections of gipsy moth eggs will be made in Connecticut this winter to determine the success of these colonies.

Calosoma sycophanta Linn.

Stonington:

On June 16, 1914, a colony containing 60 males and 50 females was liberated on Mr. E. P. Edwards' farm about one mile from depot, in an orchard almost defoliated by the tent caterpillar, *Malacosoma americana*, adjoining a wood lot where a gipsy moth egg-cluster had been found.

On the same date another colony, containing 60 males and 50 females, was liberated on York farm in the Anguilla district, about four miles from depot, in orchard infested with tent caterpillar, *Malacosoma americana*.

Up to January 1918, no recoveries have been made in the vicinity of these two Stonington colonies.

Thompson:

On July 6th, 1915, a colony containing 60 males and 50 females was liberated about 500 yards south of the Thompson railroad station.

On the same date a colony containing 60 males and 50 females was liberated in oak woodland on east side of electric railway, one mile south of Wilsonville, on property of the Grosvenordale Company.

On July 7, 1914, Mr. W. F. Kelly of the Federal Bureau of Entomology, while scouting woodland in Thompson, recovered and sent to the laboratory one male adult.

On September 12, 1916 the site and surroundings of both colonies mentioned above were scouted for larval molt skins or eaten pupae, but none were found.

Killingly:

On July 17, 1917, a colony containing 40 males and 50 females was liberated on property of C. O. Chase, near Putnam Heights, where a gipsy moth colony was found in 1916.

Mr. Harry L. Johnson of South Meriden took a specimen of this species near his home on May 24, 1915. So far as known the insect had not been planted within 40 miles of this locality.

Details of Gipsy Moth Work by Towns.

The following detailed account of the work in each town was prepared by Mr. Davis:

Thompson—518 infestations—2,837 egg-clusters.

Thompson continues to be one of the most thickly infested towns in the State. During last season 518 infestations containing 2,837 egg-clusters were located within its limits, and while there were a large number of infestations that contained only a single egg-cluster each, there were several that varied in size from 75 to 250 egg-clusters. The entire town is infested, but the eastern portion of the town is the worst, the infestations being more and more scattered as the work is carried west.

A year ago it was noted that a large number of infestations were found on the road leading from Brandy Hill to Webster, Mass. This road runs along the side of a ridge which in that section extends almost north and south, and from the top of this ridge eastward to the Rhode Island line the country was generally infested. Outside of this area large colonies which might be noted were those on the State road above Wilsonville, in a large oak near Quinebaug, and on the golf links near the Putnam town line.

The summer work was about the same as that done in previous years, namely, banding the trees around the infestation with either Tanglefoot or Raupenleim, the men attending to these bands every few days during the larval season and destroying all caterpillars which could be found there. The power sprayer was also used again and 49 of the largest colonies were sprayed with a mixture of arsenate of lead.

Scouts have already been doing some woodland scouting in this town, and several colonies have been located although but few singles have been found.

Woodstock—180 infestations—714 egg-clusters.

This town was scouted by men employed by the U. S. Department of Agriculture, as were many of the towns in the State, and the result was the finding of 180 infestations, only 30 of which contained more than a single egg-cluster.

A large number of singles were found in the vicinity of South Woodstock, but the larger infestations seemed to be in a line running from the northeast to the southwest corner of the town.

The largest colony was in the northeastern part of the town on land owned by Mr. A. T. Avery, where 130 egg-clusters were found on some pasture oaks.

The heaviest infested areas were banded during the summer and about 2,500 caterpillars were killed. The power sprayer was used in this town to spray seven of the worst infestations.

Putnam—163 infestations—488 egg-clusters.

Putnam is one of the towns in the northeastern portion of the State which have been heavily infested since the scouting was first started in 1913, and during the winter of 1916–17 one hundred and sixty-three infestations containing four hundred and eighty-eight egg-clusters were found.

As Putnam is a rather small town containing about twenty square miles, the number of infestations found shows Putnam to be about as thickly infested as Thompson, which lies to the north of it. A large number of singles were also located in this town, but most of the larger colonies were along the northern border. One exception to this was a group of infestations in some oak woods near the Killingly line. This woodland lies partly in Putnam and partly in Killingly and colonies of the gipsy-moth were found in these woods in both towns.

During the early part of the summer fourteen of the largest infestations were sprayed and in the course of the tanglefoot work which closed the last of July, over 9,000 caterpillars were destroyed besides those which were killed by spraying.

Pomfret—59 infestations—309 egg-clusters.

During the late summer and early fall of the year 1916, a crew of men worked in the western part of Pomfret at woodland scouting, but there were not many colonies located. In the winter the roadside scouting showed 59 infestations well scattered throughout the town. Only twelve of these colonies, however, contained more than one egg-cluster each, and the majority of these were in the woodland.

The largest of these infestations were banded early in the spring and the work of patrolling the banded areas was carried on until the end of July. During the spraying season, the Federal sprayer was used in Pomfret, and three of the worst infestations were sprayed.

Eastford—27 infestations—251 egg-clusters.

Just to the south-west of Eastford village, there is a large section of woodland with but a few farms scattered through it. In this area the most of the infestations found in the town of Eastford were located.

Although the most of the colonies were in the section noted, the largest infestation in Eastford, which contained 106 egg-clusters, was found about a mile northwest of the village near the Woodstock line.

Three of these infestations, including the last one mentioned, showed several larvae in the early part of the season and these were sprayed with arsenate of lead during the latter part of June. The banded trees were inspected as in previous years and continued until the latter part of July, when the season closed.

Ashford—2 infestations—3 egg-clusters.

In Ashford, only two infestations of the gipsy-moth were found last winter, and these were both near the eastern side of the town. They were both banded and patrolled but during the summer work only one gipsy-moth caterpillar was found.

Killingly—182 infestations—622 egg-clusters.

This is a rather large town, covering an area of about fifty-two square miles and extending for nine miles north and south along the Rhode Island line. In the northern portion of Killingly the infestations were rather heavy, both as regards colonies and single egg-cluster infestations. Toward the south part of the town there were no large colonies, and there was a marked decrease in the number of singles found.

It was impossible to band the trees around all of the single infestations, so only the larger colonies were thus treated, although all of the infested localities were visited during the patrolling work in the summer. Early in the month of July three of the worst colonies were sprayed.

Brooklyn—41 infestations—305 egg-clusters.

The eastern portion of the town contained a majority of the infestations, but these were practically all single egg-clusters. The largest colony in Brooklyn was located just to the west of Tatnic Hill, and here one hundred and ninety-seven egg-clusters were creosoted. Smaller colonies were found on Barrett Hill

in the northern part of the town, and in a maple swamp a little west of Church Street. The larger colonies were banded with tanglefoot and during the patrolling work over 5,000 caterpillars were destroyed. The season closed the latter part of July.

Hampton—30 infestations—248 egg-clusters.

With the exception of a group of infestations in the northern part of the town near the Pomfret line, the gipsy moth colonies were well scattered throughout the town. In this group were several colonies, but the two largest infestations were found in other parts of the town, one being in the west portion near Chaplin, while the other was in the east side about a half a mile from the Brooklyn line.

At one of the colonies in the group already noted, a large number of caterpillars were found in the early part of the summer, but prompt work caused a decided decrease in the number of larvae and it is believed that this colony has been destroyed. The spraying of a colony has proven to be a very effective means of combating this pest, and seven of the largest colonies in Hampton were thus treated during the last season.

Chaplin—4 infestations—34 egg-clusters.

The result of the scouting in the town of Chaplin last winter was the finding of four gipsy-moth colonies, the largest of which was a woodland colony in the northeastern section of the town on land owned by Mr. W. H. Phillips.

This infestation, together with the others in this town, was carefully watched until the end of the larval season, our work closing the latter part of July.

Mansfield—2 infestations—76 egg-clusters.

The town of Mansfield was found to be infested with the gipsy-moth in the year 1916 for the first time. Two infestations were discovered by scouting, and both were near the Chaplin line. One was a single while the other was a woodland colony of seventy-five egg-clusters. At the former infestation, no larvae were found during the summer work, but at the latter several were taken and the nearby foliage was sprayed with arsenate of lead.

Sterling—7 infestations—7 egg-clusters.

Since there were no infestations of the gipsy-moth found in Sterling in the winter of 1915–16, it was not thoroughly scouted

during the past winter. The work which was done in this town revealed seven infestations of one egg-cluster each.

Plainfield—1 infestation—29 egg-clusters.

There was only one infestation found in the scouting which was done in the town of Plainfield during the last winter. This colony contained twenty-nine egg-clusters, and was located a little north of the colony found the previous year. The colony did not appear very serious, for while several larvae were taken in the earlier part of the summer, only a few were taken after the first of July.

Canterbury—27 infestations—81 egg-clusters.

This town in the past few years has had many colonies located in the northern portion, and again this last season the majority of the colonies were located there. Other colonies were scattered throughout the town, but the only two important colonies were in this group. Both of these appeared serious early in the month of June, and as was the case in the other infested towns, the patrolling work was kept up until the end of July.

Scotland—4 infestations—9 egg-clusters.

The four infestations in the town of Scotland contained in all but nine egg-clusters, and although these were attended during the larval season, only eleven caterpillars were found, and those during the early part of the season.

Voluntown—4 infestations—4 egg-clusters.

Only portions of Voluntown were scouted during the winter of 1916–17 and but four single infestations were found.

Griswold—1 infestation—6 egg-clusters.

One colony containing six egg-clusters was brought to light by the scouting which was done in Griswold the last season. The trees around this colony were banded with raupenleim, and during the early part of the season a number of caterpillars were found, but none were taken after the middle of July.

Lisbon—Sprague.

No scouting was done in these two towns last winter. They have never had many infestations, and during the winter of 1915–16 nothing was found withing their limits, so it was decided to use the money elsewhere this year.

North Stonington—3 infestations—147 egg-clusters.

In the past two years the infestations found in this town have all been in one section so that this past season only that section was scouted. Three infestations were found and these contained 147 egg-clusters, all but six of which were in one colony. This colony was on land owned by Mr. William Rathburn and was situated in the southeastern part of the town. As this colony was of a serious nature it was sprayed early in the season, as was also one of the other colonies where several caterpillars were found.

Stonington—2 infestations—12 egg-clusters.

The section of Stonington which was scouted last winter showed only two infestations of twelve egg-clusters, but neither of these were of a serious nature.

Groton—No scouting was done in this town last year.

STATISTICS OF INFESTATIONS.

The following table summarizes the work by towns:

Towns	No. of Infestations	No. of Egg-clusters Destroyed	No. of Bands Applied	No. of Infestations Sprayed	No. of Larvae Destroyed
Thompson	518	2,837	8,517	49	12,945
Woodstock	180	714	2,171	7	2,620
Putnam	163	488	1,786	14	9,626
Pomfret	59	309	991	3	92
Eastford	27	251	1,079	3	904
Ashford	2	3	34	0	1
Killingly	182	622	1,410	3	1,841
Brooklyn	41	305	794	0	5,449
Hampton	30	248	133	7	1,413
Chaplin	4	34	229	0	741
Mansfield	2	76	11	1	45
Sterling	7	7	0	0	0
Plainfield	1	29	37	0	212
Canterbury	27	81	228	2	1,405
Scotland	4	9	118	0	11
Voluntown	4	4	0	0	0
Griswold	1	6	24	0	95
Lisbon	0	0	0	0	0
Sprague	0	0	0	0	0
North Stonington.	3	147	128	2	400
Stonington	2	12	0	0	0
Groton	0	0	0	0	0
Total	1,257	6,182	17,690	91	37,800

EXPERIMENTS IN SPRAYING APPLE ORCHARDS TO CONTROL APHIDS AND FALSE RED-BUG.

By W. E. BRITTON and M. P. ZAPPE.

For several years there has been much damage to the fruit crops in certain apple orchards from the attacks of red bugs and aphids. The false apple red bug, *Lygidea mendax* Reut., is responsible for the red bug injury (See Plate III) as the true red bug, *Heterocordylus malinus* Reut. has not yet been found in Connecticut. The false or lined red bug was first observed in Greenwich in the southwest corner of the State and it has caused injury there each year since, and has gradually extended northward and eastward. We have no evidence to show that it occurs throughout the State, though probably such is the case. Certainly, orchards here and there are not injured by it and it seems to be more prevalent in the southwestern portion than elsewhere in the State.

The rosy apple aphis, *Aphis sorbi* Kalt., is the species chiefly responsible for the aphid injury to the fruit. This species attacks the leaves and young fruit of the fruit clusters, dwarfing and deforming the apples, while the green apple aphis, *A. pomi.* Degeer, occurs more particularly on the leaves of water sprouts and terminal twigs. During 1917 the rosy aphis was also on the foliage of the terminal branches, but it is usually found in more shaded situations inside the crown or head of the tree.

In order to obtain data regarding the effect of nicotine sprays on these insects, some tests were conducted in the orchards of S. A. Smith & Son, Clintonville, and Frank N. Platt, Milford. The details of the treatment and results obtained are given with comments under the headings below. The fruit was not thinned in either orchard. All fruit was examined at harvest and scored as regards all insect injuries. This required a careful inspection of 98,652 apples.

SMITH'S ORCHARD, CLINTONVILLE.

The orchard consists of 6 rows of trees running nearly north and south with 11 trees in a row. The rows were numbered 1–6, beginning on the east side. Beginning at the north end the trees were numbered 1–11; the first five trees in each row are

Baldwins, the next tree is an Ohio Nonpareil, and the other five are Greenings, except for a tree here and there which has been top-grafted to Opalescent.

On May 21, four rows of trees in this orchard were sprayed with the following mixture:

Black leaf 40	1 pint
Lead arsenate (powder)	2½ lbs.
Commercial lime-sulphur	2 gal.
Water	100 gal.

Rows 2 and 5 were left as checks and were not treated with nicotine solution but were sprayed later with lead arsenate and lime-sulphur. A few trees were not sprayed at this time because the blossoms were nearly open and bees were working in them. These exceptions were tree No. 6 in each row (all Ohio Nonpareil) and tree No. 9 in row I, and trees Nos. 9 and 10 in row III (Greenings).

The spraying outfit consisted of a kerosene tractor used to work the pump and to haul the 100-gallon spray tank. A small gasoline engine mounted on the spray-tank was used to agitate the mixture. This outfit is shown on Plate II, b. The spray was applied from two lines of hose, throwing in opposite directions. One man sprayed up through the tree and the other down from the top. The pressure used was from 175 to 200 lbs. The weather conditions were ideal for spraying.

The second spraying with nicotine solution was given only to rows I and VI on June 4. The rest of the orchard was sprayed with lead arsenate and lime-sulphur but no Black Leaf 40 was used.

The fruit was picked and scored during the week of September 24–29.

The red bug injury was not serious in this orchard and it was difficult to find specimens. Nevertheless, the insect was present and was hatched from twigs cut early in the spring. The injury was slightly reduced by the treatment.

Aphids were a much more serious menace, however. Certain trees showed a large proportion of aphis apples at harvest. This injury was greatest on one of the check rows and was least where two treatments were given. A summary of the results appears in the following table:

SUMMARY OF RESULTS OF SPRAYING TREATMENTS.

Row	Good Per Cent.	Red Bug Per Cent.	Aphis Per Cent.	Codling Moth Per Cent.	Curculio Per Cent.	Maggot Per Cent.	Other Chewing Insects Per Cent.	Total Number of Apples Per Row
1	74	01	19	02	004	01	02	7,809**
2	61	02	31	02	005	002	03	9,183‡
3	63	009	32	02	001	002	02	8,388*
4	71	006	23	02	01	003	02	14,947*
5	54	02	35	04	02	001	03	11,696‡
6	80	002	10	04	02	008	02	11,552**

PLATT'S ORCHARD, MILFORD.

The section of orchard used in these tests has 8 rows of trees running nearly east and west. The four rows on the north side are Baldwin and the other four rows are Greening, Smokehouse, White and King. The rows were lettered A to H from south to north, and the trees in each row numbered 1 to 12 from west to east. The two rows in the center of the orchard were not sprayed with nicotine but left for checks. This orchard was given only one spraying and that on the afternoons of June 12, 13, 14 and 15, after the petals had fallen. The spray outfit was a common horizontal cylinder hand pump, mounted on a 100-gallon tank. Two lines of hose were used, one man spraying from a tower on the tank and the other from the ground. The pressure was not sufficient for the best results, as the trees were compact and the foliage was heavy. With this pressure the spray could not be driven through the crown of the tree. The fruit was picked and scored on August 31, October 4, 8, and 18. The crop was very light—especially the Baldwins—many trees having no fruit at all.

There was much red bug injury in this orchard. Some had already been done before the nicotine was applied. There was also considerable injury from aphis, which would in part have been prevented by an earlier application. The spray mixture was substantially the same as used in the Smith orchard. See page 260.

* One treatment.
‡ Check.
** Two treatments.

A summary of the results are given in the following table:

SUMMARY OF RESULTS OF SPRAYING TREATMENT.

Row	Good Per Cent.	Red Bug Per Cent.	Aphis Per Cent.	Codling Moth Per Cent.	Curculio Per Cent.	Maggot Per Cent.	Other Chewing Insects Per Cent.	Total Number of Apples Per Row
A	53	12	27	01	002	02	03	10,032
B	47	20	31	004	002	002	02	6,886
C	48	28	21	007	004	004	03	6,584
D*	37	44	15	007	002	001	03	7,018
E*	30	39	26	005	003	0	04	1,873
F	66	13	13	01	0	0	09	573
G	60	07	21	02	002	0	09	1,576
H	56	0	37	02	0	0	04	535

We believe that the spraying should be done earlier next year. The branches should be thinned out to let in more light and air. More effective spraying can unquestionably be done with larger pump or power outfit, capable of maintaining a pressure of from 200 to 300 lbs. per square inch.

We hope to continue the experiments another year.

THE STRIPED CUCUMBER BEETLE.

Diabrotica vittata Fabr.

Order Coleoptera; Family Chrysomelidae.

By QUINCY S. LOWRY.

For the past few years Connecticut gardeners have had considerable difficulty in growing cucumbers and squashes, due to the fact that the striped cucumber beetle has been so destructive. Consequently, in 1916 and again in 1917, one-half acre of ground was set aside at the Station farm at Mt. Carmel to carry on field experiments for controlling this and other pests of the cucumber and squash.

These small, yellow and blacked striped beetles, shown on plate IV, b, and in figure 2, are voracious feeders, not only on cucumbers but other cucurbitaceous plants, often causing the entire destruction of the first planting. In both 1916 and 1917 these beetles necessitated a complete second sowing of seed.

DISTRIBUTION AND HISTORY.

The striped cucumber beetle is especially abundant and destructive in the United States east of the Rocky Mountains and

* Rows D and E, checks.

is distinctly a native pest. As early as 1843 it was reported as an injurious insect, and in 1864 Dr. Fitch* published an article on the beetle in which he states that for more than twenty years he has had to protect his cucumber vines against the attack of these beetles.

In 1781 this beetle was described by Fabricius, in his Species of Insects, Vol. I, p. 148, under the name *Cistela melanocephala*, or the "Black-headed Cistela." A few years afterwards it was placed by him in the genus *Crioceris*, but as there was already another species having the same name he renamed it *vittata*, or "Striped Crioceris." Inasmuch as this beetle was not known at this time to be a pest outside of America, Gmelin gave it the name *Cryptocephalus americanus*, which was quite appropriate. Shortly after, Olivier determined the place of this insect to be in the genus *Galeruca*. Chevrolat, however, proposed a division of this genus, giving it the name *Diabrotica*, in which it has since remained.

Food Plants.

It is well known that this beetle feeds not only on the cucumber, squash and melon, but on all related *Cucurbitaceae*. It is frequently found feeding on the foliage of other vegetables, and the past season attacked the leaves of young peas and beans at the Station farm. Sirrine of New York, in 1899, reported that it feeds on the flowers of the apple, cherry, choke cherry and wild balsam apple. In 1916 a row of peanuts, *Arachis hypogoea* Linn., adjoining this field were found infested with these beetles. They are quite frequently found feeding on goldenrod and sunflower blossoms.

Injury.

These beetles feed during the whole season from late in the spring until October or later in the fall on cultivated or wild plants. The greatest amount of damage is caused by the adults just as the plants start out of the ground. The beetles attack the cotyledonous leaves, and in 1916 they had destroyed the entire crop before the majority of these leaves had appeared above ground. Although the greatest loss is caused at this time,

* 10th Report, Fitch's Noxious Insects of New York.

later in the season they feed on the stems of the vines and also on the flowers. This causes a weakening of the vines and to some extent prevents the setting of the fruit. The larvae feed on and tunnel in the main stems; (see Plate V); however, the damage caused by the larvae is not to be compared with that of the adult because after the stalks start to shoot out running vines they are generally vigorous enough to stand the attack from these insects. They prefer only the young and most tender parts of the plant and when the plants become woody the beetles cause no more damage except to the leaves and blossoms. It is, therefore, evident that the most damage is done when the plants are small, and the wilting of the vines, due to the work of the larvae, is not very great. The mining of the stems by the larvae has not very much immediate effect on the plants but this season there was an increased tendency of both cucumber and squash vines to develop certain forms of fungous diseases.

The loss incurred by disease due to the feeding of the larvae has been estimated at from ten per cent. to forty per cent. of the crop. Several cucumber vines this year, when from two to three feet long, became infested with a wilt, determined by the botanist of the Station to be the Fusarium wilt. Some of the more common diseases of cucumbers occurring in Connecticut are the downy mildew, *Pernoplasmopara cubensis* (B. & C.), Clint., and anthracnose, *Colletotrichum lagenarium*. This season there was comparatively little damage done to the fruit; nevertheless, the larvae work in the rinds of the fruit, causing a warty appearance. The feeding of the larvae also provides for the growth of rots and bacterial diseases. These beetles, besides being destructive to cucumbers, cause considerable damage to melon and squash, especially in market garden sections. They cause the most loss in sections where there is a scarcity of wild flowers. These beetles originally fed on the blossoms of such flowers as the goldenrod and wild species of the gourd. Although at the present time they do feed on some wild flower blossoms, they prefer to remain in vegetable gardens until the cold weather drives them to their hibernating quarters.

Life History.

ADULT. The beetles emerge from their hibernating quarters in May and June, although a few beetles may be found during

warm sunny days in April. The beetles appearing early are undoubtedly the ones that do not go into the ground to hibernate but find suitable quarters in farm buildings. The ones appearing early feed on a large variety of food plants until the squash and cucumber plants break through the ground. At this time they are ravenous feeders and usually feed a week or ten days before mating. The adults have a habit of hiding in cracks in the ground and cause considerable damage before one realizes that they are present in any great numbers. Some days, especially when it is cloudy, scarcely any beetles can be found in sight, but if the earth is disturbed a great many of them will fly about. They not only hide in the loose soil but also on the under side of the leaves. They soon begin to mate and the females shortly after begin to lay eggs. The tendency to pair is very strong and this often continues long after the egg-laying period.

EGG. The eggs are laid promiscuously (see plate IV, a), the female dropping them in crevices of the soil near the stems of the plants. They are also commonly found underneath the leaves; in fact, it appears that the female drops eggs anywhere she happens to be feeding or hiding. In the field the eggs are deposited singly. Sirrine reports that in all his field observations he had never found eggs deposited in clusters although females in confinement deposited a great many eggs in a few hours, a large proportion of these being laid in clusters. The number of eggs deposited varies from about thirty up to one hundred. The largest number ever observed deposited by a single female is one hundred and seventeen. From recent observations the female deposits all of her eggs in a single season. Some female beetles which have been kept in captivity have been known to lay eggs a second season. This was the case of a female of *Calosoma frigidum* Kirby, according to Mr. Burgess. The hatching period of the striped beetle eggs varies according to the temperature. Experiments have proved that in an average temperature of 74°F. the eggs hatch in eight or nine days.

LARVA. The larval stage is passed in the soil and may be found in the stems or on the fruit where it touches the earth. The larvae, however, can only mature in moist earth. When the larvae first hatch, unless they have moisture they will live but a short time. It requires about a month from the time the egg hatches until the larva becomes full grown. It then leaves the

plant and makes an oval, earthen cell in moist earth in which it pupates.

PUPA. The pupal stage is passed in from six days in warm weather to two weeks in colder weather. In this locality there is but one generation annually, although in Washington there are at least two, and possibly three generations in a single season.

Description.

ADULT. The general appearance of the striped beetle is shown on plate IV, b; it is a glossy, bright lemon-yellow, rather small beetle with a black head. The antennae are also black with the exception of the first three joints, which are a yellowish color. They are about two-thirds the length of the body. The thorax is not quite as broad as the wing covers. There are two indentations on the upper side of the thorax a little more than half way from its center. The wing covers are oval in outline and slightly convex. Each wing cover has nine furrows running lengthwise; in each of these furrows there is a row of small punctures. There are three black stripes on the wing covers, the middle one being on the suture. The wings are of a gray-brown color. The beetle measures about two-fifths of an inch in length (see plate IV, b), and is nearly half as wide as long.

EGG. The egg is of a light yellow or lemon-yellow color and is shown on plate IV, a. It is somewhat smaller than some of the other species, such as *Diabrotica 12-punctata*, and averages 6 mm. in length and about half as wide. It has the same markings as those of *Diabrotica longicornis* Say, figured by Forbes in the 12th Report on Insects of Illinois, page 18.

LARVA. The larva is a small, slender, soft "grub," dull-white, with a dark brown head and anal plate, the thoracic plate being light brown in color. It measures about one third of an inch in length, and is about one-tenth as thick. It has six thoracic legs and one anal proleg. It is covered with a few scattering hairs.

PUPA. The pupa is of a yellowish-white color. Its appearance is rather unique inasmuch as the antennae, legs, wing and wing covers are enclosed in separate sheaths, thus being free from the body.

Adult, larva and pupa are shown in figure 2.

PARASITES.

One of the most important natural enemies of the striped beetle is a tachnid fly, whose life cycle is passed within the adult beetle. This fly proves to be very destructive and undoubtedly helps greatly to keep this pest in check. It is known as *Celatoria diabroticae* Shimer.* Some of the ground beetles and certain species of ants feed on the larvae.

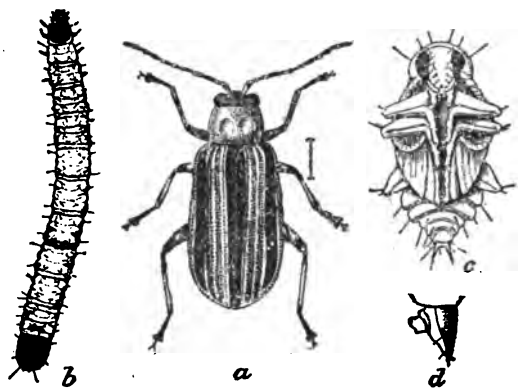

Figure 2. The striped cucumber beetle: *a*, adult beetle: *b*, larva; *c*, pupa; *d*, side view of anal segment. All greatly enlarged. (After Chittenden, Circular 31, Bureau of Entomology, U. S. Department of Agriculture.)

FIELD TESTS IN 1917.

The half acre used in this experiment was planted to twelve rows of cucumbers and fourteen rows of squashes. The treatments given were as follows:**

CUCUMBERS.

Rows 1, 2 and 3.		Land plaster or gypsum.
" 4 " 5.		Air slaked lime.
" 6 " 7.		Lead arsenate (Spray).
" 8 " 9.		" " (Dry).
" 10 " 11.		Fine coal ashes.
" 12.		Protectors.

* Chittenden, F. H. Insects injurious to Vegetables, Fig. 105, p. 157.

** The beetles were so abundant it was useless to leave any check rows. Consequently it was thought best to use the ground to the best advantage and try to protect all the rows without leaving any for check rows.

SQUASHES.

Rows 1, 2 and 3.	Fine coal ashes.
" 4, 5 " 6.	Lead arsenate (Dry).
" 7 " 8.	Black Leaf 40 and lead arsenate.
" 9.	Protectors.
" 10.	Black Leaf 40 and soap.
" 11.	Lime sulphur.
" 12.	Black Leaf 40 and lime-sulphur.
" 13 and 14.	Land plaster or gypsum.

The varieties used were Long Green cucumbers and Hubbard squashes. On April 24, strawberry boxes were used to plant the seeds. Twenty-five boxes were planted with cucumber seeds, using ten seeds in each box. Also twenty-five boxes of squash seed were planted using six in each. These were put in a greenhouse. On the 12th of May, out of 150 squash seeds planted, only 40 squash plants lived and 38 cucumber plants out of 250 seeds planted. Consequently it was necessary to replant these boxes with seeds. On May 24th and 25th one row each of cucumber and squash plants were set in the field from those started in the greenhouses and protectors placed over them like those shown on plate IV, c. The rest of the field was planted with seeds. The cucumber plants were all badly sunburned and consequently were replanted on May 31st. On June 14th and 15th the above-mentioned treatments were applied to the remaining plants, which were few. It was necessary, therefore, to plant over nearly all squash and cucumbers on June 16th.

On July 3d, in order to have a good stand several more seeds were planted in the squash plot, none, however, were planted in the cucumber plot. The protectors that were used on the cucumbers and squash were removed on this date, the plants filling the space under them.

Another application of remedies was made on July 5th, this being the last treatment given to the cucumbers.

Methods of Control.

Under ordinary conditions a great majority of these beetles can be controlled by spraying or dusting with arsenical poisons

but when they are abundant it is a difficult matter. It is, therefore, necessary to use more than one method in order to satisfactorily control this pest. Cultural methods, repellents, preventatives, and insecticidal methods are commonly practiced, collectively, to obtain the best results.

CULTURAL PRACTICES.

Clean culture is an important factor in controlling this pest. When the crop has been harvested, all refuse, including all the old vines, should be removed from the field and burned. This will destroy a great many of the beetles that would otherwise hibernate, and therefore lessen the number of beetles to attack the plants the following spring.

Plowing. After the crop has been harvested and all refuse removed, harrowing the ground lightly will kill many adults that remain near the surface before hibernating. Plowing deeply in the spring will also kill many hibernating adults.

Trap crops. Beans and squashes have often been planted as trap crops, especially by market gardeners who grow quantities of melons. Young squash plants are a favorite food of these beetles and are preferred by them to the cucumber. If squashes are planted in the spring, a week or ten days before the cucumbers or melons, the beetles will feed on them before the cucumbers push out of the ground. Then poison the squashes with arsenate of lead. Squashes or beans can also be planted around the borders of the field late in the season in order that the new generation of beetles can have tender food on which to feed. Those of the new generation feed before hibernating and if this food is provided, just as soon as they begin feeding upon it the young plants can be sprayed or dusted with an arsenical poison. This will kill many of the beetles before they seek winter quarters.

Rotation of Crops. A field that has been infested by these beetles should not be planted with cucurbits for at least two years, neither on nor near the previously infested ground. Rotation of crops for two, and better, three years, will lessen the infestation.

Fertilizers. The use of quick-acting fertilizers will enable the plants to make a quick growth. This will help them, to some extent, to outgrow the attack of the beetles.

Time of planting, etc. It is advisable in the early spring to start the plants in a greenhouse or in frames. If this is done early enough so that the plants are of a fair size when set out in the field, they will be able to withstand the attack of the beetles. If this cannot be conveniently done, it is well to plant nearly twice as many seeds to a hill as are necessary. Later, if more plants survive the attack than are needed, it is an easy matter to thin out to the desired number. Some vegetable growers recommend several plantings to be made a few days apart. This will undoubtedly prove more or less satisfactory, but it has the tendency to produce a late crop. In Connecticut, at least, it is important to produce cucumbers just as early as possible, before the market has been flooded.

PROTECTIVE METHODS.

Protectors. For many years coverings of some sort have been used as a protection for the young plants against the adult beetles. There are many different kinds of coverings on the market and many home-made devices are used. In 1916 protectors were purchased from Joseph Breck & Sons, Boston, Mass., to be used in connection with our field tests. At that time the price was $1.50 per dozen. These protectors have been used for two seasons and are shown on plate IV, c. A majority of these can be used at least another season without many repairs. Serviceable protectors can be made at home by cutting a barrel hoop in two, crossing the halves, and tacking the ends to another hoop. This frame is then covered with mosquito netting like those purchased. The protectors have proved satisfactory, although if the cloth becomes broken the beetles can crawl through. Wire screening is more substantial but more expensive. If the frames are covered with wire screening they can be used from year to year.

REPELLENTS.

Tobacco, Naphthalene. Many repellents have been used from time to time but without any particular results. Tobacco dust has been tried in Connecticut without great success, although it has the advantage of acting as a fertilizer. Naphthalene balls and flakes have been scattered around each hill without success.

Fine Coal Ashes. Finely sifted coal ashes heavily dusted around the plants are more or less satisfactory in keeping the beetles away.

Air-Slaked Lime. Dusting with air-slaked lime is an old time remedy and will prove successful when the beetles are not very abundant.

Lime-Sulphur. Spraying with lime-sulphur has given better results than some of the above-mentioned materials. If used 1 to 50, it will not injure the foliage.

Land Plaster or Gypsum. In using dry materials it is essential that the whole plant be thoroughly dusted. This is especially the case in using land plaster. If the leaves are merely covered with dust it will have the tendency to drive the beetles to the under sides of the leaves or to the stems of the plants. Where dry materials are used, the stems of many plants have been badly chewed near the surface, and sometimes beneath the surface of the ground. It is also true that even when the plants are covered with dust the beetles often feed on them.

ARSENICAL POISONS.

Arsenate of Lead. Arsenate of lead has been more successful in Connecticut than other artificial measures. This can be used either as a spray or dusted on the plants. When used as a spray, 3 pounds to 50 gallons of water is sufficient. Arsenate of lead can also be used in combination with other materials, such as Black Leaf 40 and lime-sulphur.

Arsenate of Lime. This was applied in the form of a spray (1 oz. in 1 gallon of water) at the Station farm in 1917. As this poison injured the foliage where used at this strength, it cannot be recommended.

CONTACT POISONS.

Black Leaf 40. Black Leaf 40, a nicotine sulphate solution, has been used alone and in combination with lime-sulphur and arsenate of lead. Two teaspoonfuls of Black Leaf 40, one-half ounce of soap, and two ounces of arsenate of lead is the formula used. When used alone or with lime-sulphur, this material was not very effective, but the addition of lead arsenate increased its effectiveness.

RESULTS.

The following treatments proved effective in the order given in controlling the striped beetle in 1917. The materials used

have been explained in previous pages and the results are based on the number of plants that remained after all applications had been completed.

Cucumber:

1st. Protectors.
2d. Arsenate of lead spray.
3d. Arsenate of lead, dry.
4th. Land plaster or gypsum.
5th. Air-slaked lime.
6th. Coal ashes.

Squash:

1st. Protectors.
2d. Land plaster or gypsum.
3d. Arsenate of lead and Black Leaf 40.
4th. Arsenate of lead, dry.
5th. Black Leaf 40 and lime sulphur.
6th. Fine coal ashes.
7th. Lime sulphur.
8th. Black Leaf 40 and soap.

SUMMARY.

When beetles appear in great quantities, they cannot be satisfactorily controlled by simply one method. It is therefore necessary to use different methods in combination. Some of the principal methods which will give satisfactory results are the following:

1. Protectors, young plants.
2. Arsenate of lead, dry; spray alone or in combination.
3. Dusting, arsenate of lead, land plaster, air-slaked lime.
4. Lime-sulphur spray.
5. Planting an abundance of seed; then thinning.
6. Clean culture in fall.
7. Trap crops; squash and beans in spring and fall.
8. Fertilizer used as stimulant.

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THE IMPORTED PINE SAWFLY.

Diprion (*Lophyrus*) *simile* Hartig.

By W. E. Britton and M. P. Zappe.

This European pine sawfly was first discovered in this country at New Haven, Conn., in August 1914, by the writers, who, in company with Mr. Irving W. Davis, were inspecting the stock in one of the nurseries. The larvae were feeding upon the leaves of pine trees. As the inspection work continued for several days, we later found the larvae more abundant in another part of the nursery and considerable material was gathered and taken to the laboratory.

Though unfamiliar, we supposed this to be a native, and perhaps not uncommon species. A portion of the collected material was sent to Dr. Alexander D. MacGillivray of the University of Illinois, who was engaged in the study of sawfly larvae, and who at that time had finished preparing the manuscript of the *Tenthredinoidea* for the publication entitled The Hymenoptera of Connecticut, which has since appeared as Bulletin No. 22 of the Connecticut State Geological and Natural History Survey. Dr. MacGillivray was unable to identify the larvae but thought that he might recognize the species if the adults could be obtained.

The larvae in the breeding cages matured in due season and made their cocoons. From this material the first male emerged on April 8, 1915, followed by others, and on April 15 the first female appeared. Males and females were placed in cages containing potted white pines and the females soon laid eggs. On April 21, we wrote to Dr. MacGillivray, informing him of the emergence of the adults. He examined his own cages and found that the adults had emerged there also. He replied that they belonged to the genus *Diprion*, formerly known as *Lophyrus*, but that he did not recognize the species, several of which are

badly confused; that Mr. S. A. Rohwer of the Bureau of Entomology at Washington, D. C., was trying to straighten them out and had already examined many of the types in the British Museum. He suggested that specimens be sent to Mr. Rohwer.

IDENTITY.

Following Dr. MacGillivray's suggestion, on May 6 material was sent to Mr. Rohwer, who soon replied as follows:

"I have determined this species, tentatively, as *Diprion simile* Hartig. The adults agree more closely with those in the collection under the name *pini* but the larvae answer exactly the description of *simile*, and as these two species are very closely allied and easily confused in the adults, I have made the determination from the larvae rather than from the adults.

"This species is one of the most injurious sawflies on European conifers and has been associated in practically all of the depredations caused by *pini*, and is recorded in the literature in a number of cases under the name of *pini*. You are, no doubt, familiar with the economic importance of *Diprion pini* in Europe. It is highly important that immediate measures be taken to combat this injurious insect as it has a large number of host trees and would no doubt adapt itself readily to the conditions in America, where, if it were thoroughly established without its parasites, it would do a great deal of damage."

Though two and one-half years have elapsed since Mr. Rohwer made this identification, and as he has studied the life history and food habits of the species from material furnished by us, a recent communication states that his subsequent observations serve to confirm his tentative identification. We may, therefore, consider it to be fairly well settled that this sawfly is the European *Diprion simile* Hartig. Some of the European writers place *simile* as a synonym of *pini*, but Dr. Enslin and certain other European specialists, as well as Mr. Rohwer, who has studied the species carefully from American and European material, consider them distinct.

PUBLICATIONS FROM THIS DEPARTMENT.

A brief account of the discovery of this insect in the United States was prepared with the help and approval of Mr. Rohwer, and this article, with a plate of illustrations, was published in the Journal of Economic Entomology, Vol. 8, page 379, June, 1915.

A note, with figure of larvae, was also printed in Tree Talk, Vol. 3, page 45, November, 1915.

A more complete account, or at least complete at the time, of our observations on this insect was given with bibliography in the Report of this Station for 1915, page 118. This paper was illustrated by three plates (vii, viii and ix).

A brief paper, "Further Notes on *Diprion simile* Hartig," was prepared to be presented to the Columbus, Ohio, meeting of the American Association of Economic Entomologists in December, 1915, but in the absence of the writer this paper was read by title, and printed in the Journal of Economic Entomology, Vol. 9, page 281, April, 1916.

These papers just mentioned were all prepared by the senior author.

At the New York meeting of the American Association of Economic Entomologists in December, 1916, Mr. Zappe read a short paper entitled "Egg-laying Habits of *Diprion simile* Hartig," which paper appeared in the Journal of Economic Entomology, Vol. 10, page 188, February, 1917.

Since the publication of these papers some additional information has been obtained and all have been brought together in the present paper.

Distribution in Connecticut.

Though first discovered in New Haven, this insect was soon found in Derby, Hartford, Greenwich and New Canaan, five separate towns, and three distinct and rather widely separated regions in the State.

Distribution in the United States.

Diprion simile has now been recorded not only from Connecticut but also from the states of New York and New Jersey, where it was discovered in 1916. In New Jersey it is known to occur at South Orange, Elizabeth and Rutherford.* In New York it has been taken at Flushing, Long Island. In Connecticut, Massachusetts, Pennsylvania, New Jersey, Indiana, and doubtless in other states, cocoons have been found on imported nursery stock coming from Europe.

* H. B. Weiss, Journal of Economic Entomology, Vol. 10, page 224, February, 1917.

Distribution and Damage in Europe.

This sawfly is mentioned in literature as occurring with *pini*† and therefore responsible for a portion of the damage.

In most cases, however, the serious injury is accredited to *pini*, which has seriously damaged the pine forests of Southwestern Russia‡, especially the young trees; *pini* was particularly destructive in France§ in 1906, and has also caused damage in Prussia and in Sweden. In England it is said to injure Scotch fir‖ as well as pine.¶

In 1914, larvae of *pini* nearly defoliated the ten-year old pine trees on one plantation in Norway.** The insect was reported from many localities. During the same year *pini* denuded many acres of pines in the districts of Achtyr and Izium in Russia,⊙ and caused much damage in Germany, particularly in Brandenburg and Silesia.△

Injury to Trees.

The injury consists in defoliation. The older and mature leaves, instead of the newly-formed ones, are eaten. In late summer the new growth may serve as food for the second brood larvae, so that in this manner the larvae when abundant are able to entirely defoliate trees. Plate VII, b, shows a tree of *Pinus cembra* about seven feet tall almost stripped by the larvae in 1915. Formerly it was supposed that a pine in this condition would not recover. In spite of the fact that the needles were eaten off, the buds were formed for the next season's growth, and the tree put out leaves in 1916 as usual, and as this foliage was protected by spraying, the tree did not seem to be permanently injured. If the tree had not been sprayed and the larvae abundant, the second brood larvae would doubtless have stripped it

† Kaltenbach, Die Pflanzenfeinde, page 700, 1874. Judeich-Nitsche, Forstinsektenkunde, page 635, 1895.

‡ Review of Applied Entomology, Vol. 1, pages 395 and 493, 1913.

§ A. Barbey, Traité d'Entomologique Forestière, page 269, 1913.

‖ W. E. Collinge, A Manual of Injurious Insects, page 217, 1912.

¶ E. A. Ormerod, Manual of Injurious Insects and Methods of Prevention, page 250, 1890.

** Schoyen, T. H., Review of Applied Entomology, Vol. iv, page 503, 1916.

⊙ Ibid, Vol. iii, page 443.

△ Ibid, Vol. iv, page 3.

again, and if stripped for a few consecutive seasons, it would surely be killed. According to the published accounts, in Europe the injury seems to be confined to young trees up to twelve or fourteen years of age.

Life History and Habits.

There are two broods each year in Connecticut and the winter is passed in the cocoon on the twigs. The adults begin to emerge in April and continue through May and up to July 20. Meantime most of the first brood larvae had matured and made their cocoons by the middle of June. The second brood larvae feed during August and September.

Thus it will be seen that these broods are not well separated but overlap so that it is often difficult to distinguish them.

The larval stages, on the average, last about 30.5 days. The larvae of the first brood feed upon the old and mature leaves and leave the tender new growth untouched. This new growth becomes sufficiently mature, however, to be used as food by the second brood larvae.

In our studies, nearly all of the cocoons of both broods are fastened to the twigs, but in Europe it is said that the first brood cocoons are so placed, and those of the second brood are found upon the ground.

The larvae feed with their heads toward the tip of the needle as shown on plate VI, and when very young often three or four together surround it. When feeding in this manner they eat all of the needle, but when only one or two feed they eat along the edge of the needle, making it look as though it had been scraped. When the larvae are disturbed they throw their heads back, and from their mouths exude a drop of liquid which they absorb again.

The full grown larvae, in looking for a suitable place to spin cocoons, occasionally crawl into an empty cocoon which is still attached to the tree. Then all that is necessary is to put a new top on the old cocoon. Such a case is shown on plate IX, b.

Number of Broods.

In Connecticut there are two broods (considering a brood from adults to cocoons) and in 1915 a partial third brood was obtained. The adults emerging from the second brood cocoons in this case

emerged late in the summer and were males. The broods overlap somewhat and adults from the first brood of larvae sometimes do not emerge until the following year. It also happens that the adults from the first brood often emerge before some of the adults from over-wintering cocoons.

Adults begin to emerge from over-wintering cocoons as early as April 3 and continue to emerge until July 20, while the greatest number emerge during the last half of May. Adults from the first brood of larvae begin to emerge June 19 and continue until August 28, and in two cases the adults did not emerge until early in June of the following year.

Food Plants.

In our experiments *Diprion simile* has been reared on several species of pine. The following list is arranged according to the preference shown by the sawflies in nature and to the largest number of sawflies reaching maturity in our host plant experiments:

Pinus excelsa Wall. Bhotan Pine.	5-needled pines.
" *cembra* Linn. Stone Pine.	
" *flexilis* James. Limber Pine.	
" *strobus* Linn. White Pine.	
" *Koraiensis* Sieb. & Zucc. Korean Pine.	
" *montana* Du Roi. Mugho Pine.	2-needled pines.
" *densiflora* Sieb. & Zucc. Japanese red Pine.	
" *resinosa* Ait. Red Pine.	
" *sylvestris* Linn. Scotch Pine.	
" *ponderosa* Dougl. Bull Pine.	
" *laricio* Poir. var. *Austriaca* Endl. Austrian Pine.	
" *rigida* Mill. Pitch Pine.	3-needled pine.

The 5-needled pines are preferred as food above other species and it is very easy to rear larvae on these kinds. The 2-needled species are attacked, especially the softer-needled kinds. Those having hard, stiff needles, like the Scotch, bull and Austrian pines, are almost immune. In the nursery no very young larvae were found on these species but nearly full grown ones were often found. Several attempts have been made to obtain adults from the egg stage on Austrian pine but all were failures. The larvae died during the first instar although many of them had started

to feed. Larvae which had passed the second moult on other pines and were then transferred to Austrian pine, lived and adults of both sexes emerged from the cocoons.

Eggs have been laid on pitch pine, but like Austrian pine, the larvae fed on the needles for about a week, but all died before the first moult. Attempts were made to obtain eggs and rear larvae on other conifers without success except that a few eggs were laid on white spruce; these hatched but the larvae did not feed.

MOULTS.

The larvae of this sawfly pass through five moults before they reach the pupa stage. The time between moults varies, the earlier instars from first to third are only two or three days, while the later ones are from four to seven days. The markings on the larvae do not appear distinctly until after the third moult; then they do not change in appearance except for size until they reach the prepupal stage. After this moult the larvae are much lighter in color and eye spots appear. The larvae now stop feeding and look for a suitable place to spin a cocoon, which they usually accomplish in a day or two.

1st Instar.

Larvae when just hatched have light, slate-colored bodies, head lighter, with two eye spots. After a few hours the head becomes shiny black and the eye spots disappear, thoracic legs also become black, body becomes yellowish green, semi-transparent, and the food inside the body showing darker green.

2d Instar.

Larvae look very much like those of the 1st instar except that they are a little larger. No markings are visible yet.

3d Instar.

Not much change in appearance from previous instars. Body a little darker than in 1st and 2d instars.

4th Instar.

Markings show plainly. Head and legs shiny black. There is a double black dorsal line extending the entire length of the body. On either side of the dorsal stripe there is a yellow stripe broken with transverse markings of brown. Lateral surface dark brown with many irregular yellow spots. Yellow markings protrude, making them look somewhat like blisters. Ventral surface pale yellow. Prolegs pale yellow, with transverse black marks at

base. True legs black, yellow at the joints. Body sparsely covered with minute spines; more spiny at posterior end of larva.
5th Instar.

Markings same as in 4th instar except that they are brighter, the dark portions much darker, giving the larva a somewhat darker appearance.
6th Instar (prepupal stage).

Head greenish with black eye spots. Legs light green, markings same as in other moults but colors very light, making general appearance of larva much lighter. Prolegs not very well developed in this stage and are of little use, larva falling from twigs very easily.

Larvae now spin cocoons and remain in larval stage until shortly before adults emerge, when they pupate. The pupal stage lasts only for a few days.

Description.

The appearance of this insect in all its stages is shown on plate VI, and briefly may be described as follows:

Egg. The eggs are laid end to end in slits made along one of the ridges at the edge of the needle as shown on plates VI, 2, and IX, c. The eggs are pale blue in color, smooth and slightly shining. The sides are parallel with the ends rounded. Length, 1.25 mm., thickness, .33 mm. In the material examined the newly-laid eggs were slightly separated in the slits. The eggs before hatching increase in size, becoming crowded in the slits so that the ends are flattened like peas in a pod.

Larva. Length, 25 mm. (1 inch) to 28 mm. ($1\frac{1}{8}$ inches). Thickness, 4 mm. (5/32 inch). Head black, body greenish-yellow with a mid-dorsal double stripe of brown extending the entire length. On either side of the dorsal stripe is a yellow stripe broken with transverse markings of brown. The remainder of sides dark brown with many irregular yellow or whitish spots. Ventral surface pale yellow or white. Prolegs yellow with a transverse black mark at base, true legs marked with black and yellow. Shown on plate VIII, b.

Cocoon.—9 mm. long (about 3/8 inch), thickness about 5 mm., oval in shape, tough, leathery and fairly smooth. Color, sepia. See plate VIII, c.

Male. Wing-spread, 14 mm. (9/16 inch). Length, 7 mm. Large pectinate antennae. Head and pronotum coarsely punctured. Head, antennae and body, black. Cerci and tip of the last abdominal segment, orange. Legs yellow, with the trochanters and basal two-thirds of the femora, brownish black. Shown at the right on plate VI, 1.

Female. Wing-spread, 20 mm. (little over 3/4 inch). Length, 8 mm. (5/16 inch). Robust, head and antennae black. Thorax coarsely punctured, yellow with a large shield-shaped black spot on mesothorax, extending from the anterior margin and covering about two-thirds of the space between the parapsidal grooves. On either side are a pair of L-shaped black marks which approach each other posteriorly. Posterior margin of the mesothorax, postscutellum and prosternum, black. Abdomen yellow with dorsal surface of 3d, 4th, 5th, 6th and the anterior portion of 7th segment, black. Legs yellow with the outer surface of hind femora, the apex of the middle and hind tarsi, dark. Shown at the left on plate VI, 1.

Egg-Laying Habits of the Female.

On emerging from the cocoons in the breeding cages, the females begin to run aimlessly about, going all over the pine twigs for a period which is more or less indefinite but which usually averages about twenty-four hours. They then commence to deposit eggs. In ovipositing the female places herself on the pine needle facing its tip, and grasps it firmly with her tarsi, the hind legs extending slightly beyond the abdomen. The ovipositor is then inserted in the edge of the needle and a slit is cut in it, working from the base toward the tip. When this incision has reached a length of about one-tenth of an inch, the sawfly rests for a few seconds, then lays an egg placed horizontally in the slit, gradually drawing the ovipositor backward and out of the needle. This withdrawing of the ovipositor partially covers the egg with resin and sawed pulp from the leaf. She then moves forward and proceeds to cut a slit in which the next egg is placed. The eggs are thus placed end to end in the incision, as many as twenty sometimes being placed in line in the needle as shown on plate IX, c. The time required to lay a single egg is about four minutes in *Pinus excelsa* and about five minutes in *Pinus densiflora*.

The females usually begin to lay eggs in about a day after emerging from the cocoons, and live for about seven days, while those individuals (about eleven per cent.) which do not oviposit die in four or five days. With the males the length of life varies; some individuals live longer than the females, and some do not.

The eggs are usually laid in needles of the previous season's growth, if such are present. Most of the eggs for the first brood hatch during the first half of May, and those for the second brood early in August, though the broods overlap, and it sometimes happens that some of the first brood females are so late in emerging from their cocoons that their eggs do not produce larvae until after some of the second brood eggs have hatched.

Number of Eggs Laid.

Upon dissecting the bodies of females from over-wintering cocoons, an average of 58 eggs was found in each. The number of eggs in a female of the first brood averaged 76, while those of the second brood averaged 74. The largest number of eggs recorded as having been laid by one female was 128; this is more than we ever dissected from the body of any female sawfly. The average number of eggs laid was 64.

Parthenogenesis.

In our studies of this insect, copulation has been observed only once, but eggs are laid which develop and hatch if males are not present. Moreover, the presence or absence of males has no apparent effect on the number of eggs laid. Some females oviposit when males are present and others do not. The only time copulation was observed, the pair of adults were transferred to a breeding cage to obtain eggs and larvae. The female died in a few days and upon examining the cage no eggs were found.

In thirteen cases the adults reared from eggs laid by virgin females were all males. Out in the field under natural conditions the number of females emerging from over-wintering cocoons was slightly greater than that of males. Out of 1,675 adults from over-wintering cocoons, 912 were females and 763 were males. During the summer of 1917 a freak adult or gynandro-

morph emerged from some cocoons collected in the field. It has one female antenna and the other is that of a male sawfly. The left side, including antenna and markings on thorax, is that of a female, while the right side has a male antenna and the thorax is without markings—just black like the males. The abdomen is darker than that of a female, yet lighter than that of a male. It also has the characteristic female ovipositor. The specimen was killed in a cyanide tube before we discovered that it was a freak. This specimen is shown on plate IX, d.

PARASITES.

About twenty-eight per cent. of the cocoons of *Diprion simile* collected during the winters of 1915–16 and 1916–17 showed the exit holes of parasites. Following is a list of the nine specie reared, arranged in the order of their abundance:

Hymenoptera.

Dibrachys nigrocyaneus Norton (*Pachyneuron*), *Monodontomerus dentipes* Boheman, *Dibrachoides verditer* Norton (*Pteromalus*), *Delomerista* n. sp., *Cerambycobius* sp. (probably new), *Eurytoma* sp., *Hemiteles utilis* Norton.

Diptera.

Exorista petiolata Coquillett.

Of these nine species of parasites only the first three were reared in sufficient numbers to indicate that they are at all effective in holding the pest in check, and of the three, *Dibrachys nigrocyaneus* Norton was by far the most abundant.

During the winter of 1916–17, 3,240 cocoons were collected. Of these, adults emerged from 41 per cent., 37 per cent. were parasitized, and 6 per cent. were torn open by birds, mice or squirrels, and the pupae eaten. The remaining 16 per cent. produced no living insects, but when the cocoons were opened a large number of them contained dipterous pupae; in some of these the adult flies had broken off the ends of their pupa cases preparatory to emerging. See plate IX e. Tachinid eggs were found on many of the *Diprion* larvae in the field, but only one fly (*Exorista petiolata* Coquillett) has been reared. Apparently all of the others have been unable to escape from the tough *Diprion simile* cocoons. The cocoons of our native species are not as tough as those of *D. simile*.

The figures and percentages mentioned in the preceding paragraph are shown in the following table:

Cocoons Collected During Winter 1916–1917.

	Number	Percentage
Adult sawflies emerged	1,321	41
Parasites emerged	1,210	37
Torn open and eaten	191	6
Dead	518	16
Total	3,240	100

In the field many dead larvae were found on the trees suspended by their prolegs, having been killed by a wilt disease. This disease seems to be the most prevalent late in the season, and is effective in killing the larvae of the second brood. It also seems to be more prevalent on trees which have been stripped, though possibly it is because they are more conspicuous on such trees.

In regard to the insect parasites listed above, all those specifically identified are native species with the exception of *Monodontomerus dentipes* Boh., which is a European species which had been found previously in the United States. *Dibrachoides verditer* Norton and *Dibrachys nigrocyaneus* Norton were originally described from Connecticut.

Probably Introduced on Nursery Stock.

The most plausible theory is that this sawfly was brought into this country on nursery stock. A few cocoons attached to the leaf-covered twigs might easily escape notice by the inspector in examining the imported stock, especially before its presence in this country was discovered. Cocoons might also occur in the ball of earth on the roots, as it is seldom possible with the help and funds available in Connecticut to examine carefully the soil about the roots. Empty sawfly cocoons have been found in cases of azaleas from Belgium.

Since 1909, when nests of the brown-tail moth were found on nursery stock coming into this country from Europe, an attempt has been made to inspect all shipments of field-grown woody plants coming into Connecticut from all foreign countries. At first it was impossible to trace all shipments and we were obliged to depend chiefly upon information furnished us by the nurserymen. Most of the importations arriving at the principal nurseries were

inspected but florists and private owners also made importations and there were unquestionably a number of shipments each year which were not examined. On the establishment of the Federal Horticultural Board in 1912, the system of permits and notices has enabled us to trace each shipment and practically all such stock has been examined. But there were probably many shipments brought into the State prior to 1909, and these were not inspected at all. On account of the blister rust diseases and the pine shoot moth, all pines are now prohibited from entering the United States from Europe.

Since the establishment of the Federal Horticultural Board and the present system of inspecting imported nursery stock, sawfly material has been intercepted at least eleven times, as follows:

Sawfly	Host	Source	Destination
Cocoon.....	Fruit trees.....	England.....	New Jersey
Larva.....	Box.....	Holland.....	Indiana
Diprion pini....	Mugho pine.....	"	Massachusetts
Cocoon.....	Spruce.....	"	Nebraska
"	Azalea.....	Japan.....	New Jersey
" (empty)	" .....Belgium.....		Connecticut
Diprion simile..	?	Holland.....	Indiana
Cocoon.....	Quince.....	France.....	Nebraska

It will probably never be known just how, when or where this insect was first brought into the United States. Possibly it was first introduced into the very nursery where it was first discovered, though other nurserymen in Connecticut and hundreds of them in other states have imported pines from Europe, and the insect might have come in any of these shipments.

Danger to the Pine-Growing Industry in the United States.

It is impossible to foretell how serious a pest this sawfly may become in the United States. Any introduced insect which feeds upon an important crop is dangerous; doubly so if its natural enemies are left behind. As the food plants of *Diprion simile* are fairly abundant in this part of the country, and the climate seems to be favorable, it is probable a question of parasites and other natural enemies that will determine its status as a pest here. It is encouraging that our native species parasitize it so freely.

Control Measures.

In each infested nursery in Connecticut, the owner has been required to spray the pines with lead arsenate (3 lbs. in 50 gallons of water) late in summer when the second brood of larvae were feeding. Later, after all larvae had transformed, a careful inspection was made of each tree and all cocoons removed. These measures appeared to be necessary in order to reduce to the minimum the danger of further distributing this pest on nursery stock. A similar spraying early in May would forestall injury by the first brood of larvae.

Ornamental trees and small plantings on private grounds can likewise be sprayed, but the cost would be prohibitive in large forest areas.

In Europe it is recommended that the leaves and other rubbish be gathered and burned late in fall in order to destroy the cocoons, but this method can hardly be advised in this country, as all the cocoons are fastened to the twigs. Some cocoons were found upon the ground during the winter and spring, but these had probably been torn off by snow or ice storms, or possibly by birds.

In Russia, V. G. Averin* recommends as control measures that larvae be shaken into pails, crushed on the branches with leather gloves, and that the trees be sprayed with barium chloride (5 lbs. in 27 gallons water) and with Paris green.

In Germany,† outbreaks were checked by collecting the larvae and by spraying with petroleum soap emulsion. It is said that on an estate of about 150 acres near Danzig in 1905, the pines were cleared of 1,412 litres (5,600,000 individuals) of larvae at a cost of about $50.00. The following year (1906) about half of this area or 75 acres were cleared of 201 litres (800,000 individuals) at a cost of about $7.00.

Acknowledgment.

The writers herewith express their indebtedness and thanks to Mr. S. A. Rohwer of the Bureau of Entomology, Washington, D. C., who has identified specimens, furnished references and examined the manuscript of this bulletin.

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* Journal of Applied Entomology, Vol. iii, p. 106, 1915.
† Ibid, vol. iii, page 3, 1915.

SUMMARY.

Diprion simile, a dangerous European sawfly, has been brought into the United States, probably on nursery stock. It was first discovered in Connecticut in 1914, but has since been found in New Jersey and New York, having apparently become established in these three states independently. It has also been found on imports entering Massachusetts and Pennsylvania.

In Europe this sawfly has been associated with *Diprion pini* in many serious outbreaks, notably in Russia, Germany, France, Norway, Sweden and England.

The larvae injure pine trees by feeding upon the leaves of several species, preferring the five-needled pines. There are two generations in Connecticut, and possibly a partial third generation in favorable seasons.

This insect passes the winter in the cocoon stage on the twigs and the adults begin to emerge the latter part of April. Egg-laying soon begins in the needles of the previous season's growth. The first brood larvae feed during May and early June, and the second brood larvae feed during August and September. Each female lays, on the average, 64 eggs. The first brood larvae feed on the old needles rather than the new tender growth, but this new growth becomes sufficiently mature to serve as food for the second brood larvae. Thus trees may be stripped in one season.

The larva moults five times before reaching the pupa stage, and when fully grown is about an inch long, with body greenish-yellow, with a double brownish stripe extending along the back. On each side of this stripe is a yellow stripe crossed by narrow brown markings. Head black.

The adults are robust, with transverse clouded areas on the wings. The female has slender antennae, and thorax and abdomen are yellow with black markings; the male has broad, pectinate antennae and is nearly all black.

Apparently this sawfly is parthenogenetic, for without the intervention of males, eggs are laid which hatch and develop normally.

The cocoons are strongly parasitized, nearly 50 per cent. being killed. Eight species of hymenopterous parasites and one dipterous parasite have been reared. Three of the former, *Dibrachys nigrocyaneus*, *Monodontomerus dentipes* and *Dibrachoides verditer*, bid

fair to become effective in checking the pest. Of these, the first is by far the most abundant. The first and third are native American insects, and the second is a European species which has previously been recorded from the United States.

Whether or not this sawfly seriously injures the pine growing industry in this country probably depends on its parasites.

Spraying the pines with lead arsenate early in May, and again in August, and destroying the larvae and cocoons when found, are the control measures to be practiced.

This insect in its various stages is shown on plates VI-IX.

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OUTBREAK OF THE PINK AND GREEN POTATO APHID, *Macrosiphum solanifolii* Ashmead.

By W. E. Britton and Q. S. Lowry.

On July 9th, while the entomologist was absent on a vacation, several inquiries were received at the office about aphids on potatoes. The Frank S. Platt Company of New Haven telephoned that it had received complaints from all over the State, and asked for a remedy. Nicotine solution was advised. For a period of about two weeks there were many inquiries by telephone and by mail from various parts of the State, but chiefly from Hartford,

Waterbury, New Haven and the regions surrounding these cities, and Mr. Lowry was kept busy answering them.

There was such a demand for information, and prompt action being necessary, that the Director, after conferring with the assistant entomologists, prepared the following press notice, which appeared in the daily papers of July 16th:

"DANGER FROM THE POTATO APHID.

An aphid or plant louse is very abundant on potato vines now and threatens very extensive damage to the crop.

Control by spraying now is very difficult because of the heavy growth of vines and the fact that the lice are abundant on the lower surface of the leaves.

Spraying the upper surface alone is not effective. The best remedy that we can recommend is a nicotine spray with soap solution made as follows:

One-half pint 'Black Leaf 40' and two pounds whale oil soap or yellow soap dissolved in a barrel of water. For use on a small scale dissolve one to one and one-half teaspoonfuls of 'Black Leaf 40' in a gallon of water, with a piece of soap about an inch square. Any other tobacco preparation may be substituted which carries as much nicotine as the one named above. The full amount given in the manufacturer's directions should be used. To be effective the spray must cover not only the upper surface but the under side of the leaves as well, and also the tender stems, therefore the spray must be directed in part from beneath upward. This spray containing soap cannot be applied with Bordeaux mixture but may follow or precede it by a few days."

Infested potato fields were reported from every county in the State and from the following localities:

Fairfield County—South Norwalk (turnip), Redding.

New Haven County—New Haven, Westville, North Haven, Montowese, West Haven, Mount Carmel, Cheshire, Branford, North Branford, Meriden, Middlebury, South Britain, Naugatuck, Waterbury.

Middlesex County—Middletown.

New London County—New London.

Litchfield County—Harwinton, Thomaston.

Hartford County—Hartford, East Hartford, Thompsonville, Wethersfield, Farmington, New Britain, Plainville, Bristol.

Tolland County—Bolton.

Windham County—Killingly.

It was doubtless present in many other localities, though not reported to the Station.

In 1903 this aphid was abundant on potatoes in Fairfield, and in 1909 it was found on potatoes in the Station garden by Mr. Arthur I. Bourne, then an assistant in this department. On July 18, 1912, it was received on both potato and corn from Mr. Noyes Palmer of Stonington, and on potato from Mr. Alfred L. Beebe of Mystic. These last-mentioned infestations were apparently local, and no great or widespread damage was reported.

Prior Connecticut Records of this Species.

The aphid material in the Station collection was determined chiefly by Dr. Edith M. Patch of the Maine Agricultural Experiment Station, Orono, Me., and contains several microscope slides of *Macrosiphum solanifolii* Ashm. From these the following data are taken:

Host	Locality	Date	Collector
Potato	Mystic	18 July, 1912	A. L. Beebe.
Tobacco	So. Glastonbury	27 July, 1904	W. E. Britton.
	New Haven	22 July, 1909	A. I. Bourne.
Ground Cherry (*Physalis pubescens*)			
	Meriden	21 Sept., 1908	W. E. Britton.
Jerusalem Cherry (*Solanum pseudocapsicum*)			
	New Haven	27 July, 1909	A. I. Bourne.
Squash	New Haven	21 July, 1909	A. I. Bourne.
		8 July, 1914	M. P. Zappe.
Beet	New Haven	30 July, 1909	A. I. Bourne.
	Milford	19 July, 1915	W. E. Britton.
Lettuce	New Haven	22 July, 1909	A. I. Bourne.
Milkweed (*Asclepias* sp.)			
	New Haven	29 June, 1916	B. H. Walden.
Clematis crispa	New Haven	18 June, 1901	W. E. Britton.
Bitter Sweet (*Celastrus scandens*)			
	Windsor	19 June, 1912	Mrs. Mary Allen.

Distribution in the United States.

This aphid was first described from Florida by Ashmead in 1882, on wild pepper vine, *Solanum jasminoides*. As it has also been recorded from Maine, Canada, California, and a number of the states between, it is fair to assume that it may occur throughout the United States.

Davis,* writing in 1904, states: "Although not commonly and generally a pest of the potato in Illinois, I have occasionally found it exceptionally and injuriously abundant."

* Jour. Econ. Ent. Vol. 4, page 330, 1904.

In 1904, 1905 and 1906, this insect was prevalent in Aroostook County, Maine, and caused much damage to the potato crop.

Certain potato fields in Iowa** were infested in 1912, but natural enemies promptly checked the outbreak before much damage was done.

According to available reports, aphids were prevalent on potatoes in 1917, in Illinois, Indiana, Missouri, Kentucky, Ohio, Pennsylvania, Maryland, Virginia, District of Columbia, New Jersey, New York and Massachusetts, as well as in Connecticut. Possibly in some cases the damage was done by another species, known as the green peach aphid, or spinach aphid, *Myzus persicae Sulz.*, which is common everywhere, and which seemed to be the chief species on potatoes in some of the southernmost states named above. This aphid may attack almost any kind of vegetable crops.

Injury.

The aphids caused the leaves to curl and the plant to assume the appearance shown on plate X, a. The leaves soon turned brown on the edges and the vines were soon killed. Apparently this infestation seriously checked the crop; the tubers were arrested in their development and a very small yield resulted. In a field at the Station farm at Mt. Carmel, the vines were large and vigorous and promised a good crop; but this field was heavily infested with aphids in July, and though sprayed and most of the aphids killed, the plants did not recover and died in a few days. The yield was very small, some portions of the field being hardly worth digging. Plate XI,b, shows a field where the vines have been killed by aphids.

On the other hand, Mr. A. N. Farnham of New Haven raised one of the best crops of potatoes in 1917 that he has ever grown. He planted early varieties as soon as the ground could be worked and matured the crop before the aphids came. One field at the Station farm gave a fair yield, but this was an early variety planted late, and was not attacked by aphids.

The aphids are usually on the under side of the leaves and on the tender shoots of the potato. The following account of injury is taken from Bulletin 317, Ohio Agricultural Experiment Station, page 69:

** Bull. 155, Iowa Agr. Expt. Sta., page 400, 1915.

"The tender leaves on the tip of the plant are first to be attacked: and as the leaf develops and the lice continue their sap-sucking, devitalizing work, the edges turn downward and after a short time the whole structure takes on the distorted, contracted aspect so characteristic of the work of many aphids.

"In the later stages, the plant dies from the top downward. It is difficult to determine the actual damage the insect inflicts in cases where the plant is not killed outright. Unquestionably the production of tubers is minimized when the leaves of the top become badly curled: indeed, the curtailment may be considerably greater than is realized. In addition to the primary harm inflicted, we must attribute a part of the damage caused by plant diseases directly to the aphids, since on account of their well-known migrating habits they unquestionably are a factor in disease dissemination."

On tomato in Ohio no fields or plants were killed outright, though the aphids, as on potato, attack the tender shoots and leaves and cause the leaves to curl. A favorite place is on the blossom clusters, and they cause the blossoms to fall without the fruit setting, thus greatly reducing the yield. On egg-plant and pepper the greatest injury, as on tomato, resulted from a failure to set fruit on account of the stems being devitalized by the attacks of the aphids.

Dr. Felt estimates that on Long Island and in the southern part of New York state, where the aphid attacks were the most severe, at least one-fourth of the potato fields were very seriously damaged, and the vines killed.

Habits and Life History.

This aphid passes the winter in the form of a shining, oval, black egg, which, according to Dr. Patch, occurs more often upon the rose than any other plant. On the approach of warm weather in spring these eggs hatch into agamic viviparous females, which are usually found on the new rose shoots and especially around the flower buds in early summer. Some of these females acquire wings and fly to the potato fields; the wingless forms travel by walking if a potato patch is sufficiently near. Thus usually by July 1st the aphids have become colonized on potato and only a few stragglers are left upon rose.

According to Dr. Patch, a female may produce 50 or more young in two weeks, and in warm weather these may become mature in two weeks and in turn begin to produce living young.

On the potato the aphids seem to find favorable conditions for growth and development and increase at an enormous rate. In Ohio only ten days are required for the young to reach maturity; hence several generations are possible during the summer breeding season. Finally a true sexual generation is developed in the fall, consisting of winged males and wingless females, the latter laying eggs on the rose or other host to carry the species through the winter. In Ohio, studies were made on the rate of reproduction. One female was caged on a plant which had been freed from its entire aphid population, and at the end of two weeks the colony consisted of 76 aphids, five of which were producing young. Counts were made of the aphids on three tomato plants: No. 1, a small one having seven leaves, had 1237 aphids; No. 2, a large branching plant with 12 stalks, had 34,688 aphids; No. 3, also a large spreading plant, had 25,750 aphids. Plate X, a, shows a tomato shoot infested with aphids.

Both Dr. Patch in Maine and Mr. Houser in Ohio noticed the strong tendency of the winged forms to drop to the ground when the host plant is disturbed.

Host Plants.

Besides attacking potato, this aphid injures tomato and egg-plant, and is found on many other hosts. In Ohio in 1917*, potatoes, tomatoes, egg-plants and peppers were attacked and severely injured. In Connecticut, we have only one report to show that it infested tomato, one on turnip, and none to show that it caused injury to plants other than potato in 1917. A list of the known host plants follows: Potato, tomato, egg-plant, pepper, pea, sunflower, rag-weed, jimson weed, lambs quarters, sweet potato, turnip, ground cherry (*Physalis*), shepherd's purse, canna, hollyhock, matrimony vine, corn, beans, plantain, moth mullein, smartweed, curly dock, catalpa, pokeberry, iris, gladiolus, red-root pigweed, apple, pepper-vine, aster, cineraria, buckwheat, rose and lettuce.

In 1912, this insect was received on corn and potatoes from Stonington, the potato leaves being badly infested.

Description.

The appearance of the winged viviparous female is shown in figure 3.

*Bull. 317, Ohio Agr. Expt. Station, November, 1917.

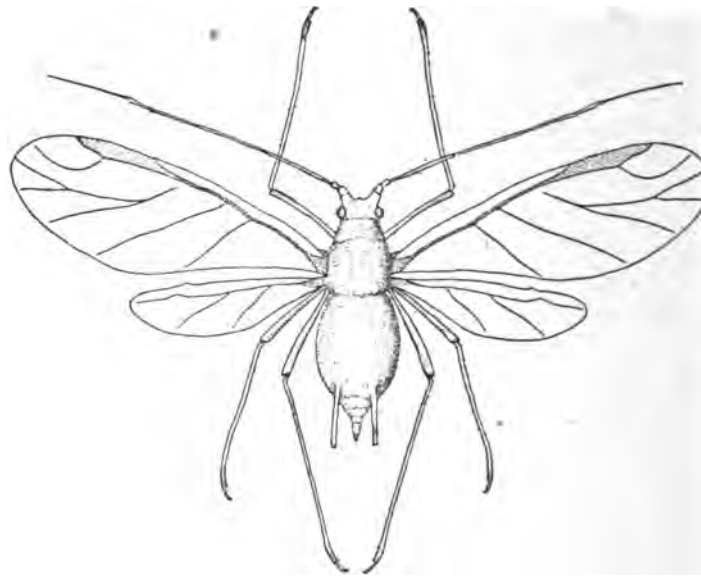

Figure 3. The potato aphid, winged female. summer form. Greatly enlarged.

The following description was published by Dr. Patch in Bulletin 242, of the Maine Agricultural Experiment Station, page 208:

"In general *Macrosiphum solanifolii* is a large species either green or pink. The apterous forms are somewhat inclined to drop from the plant when disturbed. The abdomen is not marked with dark, but is ordinarily clear in color either pink or green, though sometimes late in the season individuals may be found with a mottling part pink and part green. The mature forms are rather glistening, but in the stage previous to the last molt the insect usually has a mid-dorsal line of dark green or pink (according to the color of the individual) while the rest of the dorsum is paler by virtue of a very slight powdery deposit. This appearance is more noticeable in bright light. The beak is short, usually, not or barely reaching the second coxa, though certain collections have been taken with beaks a little longer. The cornicles are characterized by reticulations at the tip. This reticulation holds true for all the mature individuals—alate and apterous viviparous females, oviparous females, and males—whether of the green or pink variety, and regardless of the food plant upon which they have developed. The cornicles of the immature individuals are not so marked. The antennae of the apterous

females are a little swollen at the proximal part of III. where a few sensoria are placed; those of the alate females have the sensoria in a single row not extending to the distal tip of III. The wing veins are clear cut and well defined though slender.

" The foregoing are the general recognition marks. There is no structural difference between the spring and the fall individuals great enough to lead one to think they might be different species; though there is a range in size, influenced by food plant or other conditions, great enough to cause hesitation in determining certain collections unless the progenitors are known. The measurements, therefore, in the following descriptions can only be taken as approximate.

" *Winged viviparous female, green variety.* Head yellowish green. Beak typically barely reaching second coxa, though in some collections a little longer. Antennae, proximal segments pale green, distal segments dark; length of segments: III, .88 to .96 mm.; IV, .76 to .9 mm.; V, .64 to .72 mm.; VI, base .16 to .2 mm.; VI, spur .96 to 1.12 mm.; total length I to VI, 3.6 to 4.05 mm. III with single row of sensoria somewhat irregular in size numbering 18 or a few more or less, not extending to distal end. Prothorax and thorax light yellowish green, lobes brownish. Wings hyaline, veins dark brown, very slender and clear cut, stigma pale brown. Total wing expansion 8.1 mm. Legs with proximal part of femora and tibiae pale, tarsi and distal part of femora and tibiae dark. Tarsi .16 to .2 mm. Abdomen light green unmarked dorsally or ventrally. Cornicles, with proximal portion green and distal portion dark brown, imbricated for more than three-fourths its length but strongly reticulated at tip, cylindrical, length .95 mm. or about five times length of tarsus. Cauda light green, ensiform, length .48 mm. or about one-half length of cornicles. Total length of body to distal tip of cauda and exclusive of antennae 2.9 to 3.37 mm.

" *Winged viviparous female, pink variety.* Head light yellowish. Antennae with I and II light yellowish, rest dark. Sensoria as with the green variety. Prothorax and thorax light yellowish pink. Abdomen pale pink. Cornicles light yellow with tips dusky and strongly reticulated. Cauda pink. Measurements the same as with the green variety.

" *Wingless viviparous female.* Color either pink or green as with the winged viviparous form. Antennae, length of segments: III, .8 to .96 mm.; IV, .72 to .88 mm.; V, .56 to .72 mm.; VI, base .16 to .2 mm.; VI, spur .96 to 1.2 mm.; total length of segments I to VI, average about 4.05 mm. III slightly swollen at basal third where 1 to 5 sensoria occur. Cornicles .96 to 1.04 mm. in length, and strongly reticulated at tip about one-fifth the distance. Cauda .56 mm. Total length of body to distal tip of cauda exclusive of antennae, 4.05 mm.

" *Wingless oviparous female.* Head pale, nearly white. Antennae with proximal joints pale, distal half dark. Length of segments: III, .68 to .88 mm.; IV, .56 to .68 mm.; V, .52 to .64 mm.; VI, base .16 mm.; VI, spur .96 to 1.04 mm.; total antennal length I to VI average about 3.6 mm. Legs with femora and tibiae, proximal portion pale, distal

portion dusky. Tarsi dark, .16 mm. long. Hind tibiae conspicuously darker and much swollen and thickly set with sensoria. Abdomen light salmon pink. Cornicles pale at base, distal half dark and reticulated at tip; length .6 to .8 mm. Cauda salmon pink, ensiform, length .32 to .4 mm. Total body length to tip of cauda, antennae excluded, 2.13 to 2.15 mm. The size of the hind tibiae of this form makes it readily distinguished from the apterous viviparous form and young, even to the unaided eye.

"The pink variety has been described because these predominate among the oviparous females. The color scheme of the green and yellow forms can be determined merely by substituting these colors for the salmon pink of the individual described, the dark coloration being the same for all three.

"*Winged male.* Head and antennae dark brown. Length of antennal segments: III, .72 to .8 mm.; IV, .48 to .64 mm.; V, .48 to .6 mm.; VI, base .16 mm.; VI, spur 1.04 to 1.28 mm.; total antennal length I to VI, 2.93 to 3.60 mm. Sensoria numerous on III, usually none on IV, and an irregular row of them nearly the whole length of V. Prothorax and thorax dark brown. Wings hyaline, veins dark and very slender, stigma pale brown. Legs brown, darker at tips. Abdomen greenish or brown. Cornicles pale brown, dark distally and reticulated, cylindrical, .48 to .56 mm. long. Total body length exclusive of antennae and cornicles, 1.12 to 1.57 mm. The thorax is large and strong, the abdomen much shrunken, making the cornicles seem conspicuously long. The male is described from individuals taken in copulation, in order that no mistake as to the identity of the species might occur."

Parasites and Natural Enemies.

Nearly all aphids are preyed upon by adults and larvae of lady beetles, and by the larvae of lace-wing flies and syrphid flies, and these were all observed in connection with aphids on potato in Connecticut, though we did not have time to study them and to rear and identify the species. A lace-wing larva, a lady-beetle larva, and a syrphid larva are shown on plate XI, a.

In Ohio the following nine species of adult lady-beetles were observed feeding upon the aphids:* The two-spotted lady-beetle, *Adalia bipunctata*, the nine-spotted lady-beetle, *Coccinella novemnotata* (ix-*notata*), the red lady-beetle, *Cycloneda munda* (usually listed as *Coccinella sanguinea*, a tropical species), the convergent-lady-beetle, *Hippodamia convergens*, the glacial lady-beetle, *H. glacialis*, the parenthesis lady-beetle, *H. parenthesis*, the thirteen-spotted lady-beetle, *H.* xiii-*punctata*, the spotted lady-beetle, *Megilla fuscilabris* (usually listed as *maculata*, a tropical

* Bull. 317, Ohio Agr. Expt. Station, page 78, November, 1917.

species) and *Brachyacantha ursina*. The most common species were *Hippodamia convergens* and *Coccinella novemnotata*. An adult of the latter was observed to eat six aphids in 22 minutes, and a larva ate three aphids in 12 minutes.

The larva of a species of *Chrysopa* or lace-wing fly, though present and feeding upon the aphids, was not sufficiently abundant to be an important factor in checking the pest.

Three species of syrphid flies, *Syrphus americana*, *Sphaerophoria cylindrica* and *Allograpta obliqua*, in the larval stage fed upon the aphids.

The above mentioned lady-beetles, lace-wing fly and syrphid fly larvae are predaceous and devour the aphids in large numbers. There are also the four-winged or hymenopterous parasites, of which four species were very abundant in Ohio, namely, *Aphidius polygonaphis*, *Pachyneuron aphidivorum*, and two species of *Lygocerus*, the first being the most abundant. These are internal parasites, and are very effective in keeping aphids in check. When parasitized by them, the aphids become swollen, turn brown and remain fastened to the leaves. Such parasitized aphids were noticed on some of the potato leaves brought to the Station. These or similar natural enemies have been observed in Maine and Iowa attacking potato aphids.

Mr. Zappe collected some parasitized aphids on potatoes in Stratford, July 23, 1917. On July 26 and 30 some small ichneumon or four-winged flies emerged from them. These parasites were sent to the Bureau of Entomology, and through the kindness of Dr. L. O. Howard were identified by Mr. A. B. Gahan. All proved to be *Aphidius rosae* Halliday, a species which has several times been collected or reared within the State.

All of the lady beetles, the syrphid flies and the lace-wing mentioned above are common species in Connecticut. Though the four-winged flies found in Ohio have not so far been recorded from Connecticut, it is probable that they occur here. At any rate, these or closely allied species are certain to be present in Connecticut fields and serve as important checks in any aphid infestation.

In Ohio, chickens, the English sparrow, the chipping sparrow and the quail were observed to feed on potato aphids. A fungus, *Empusa* (*Entomopthora*) sp., killed many of the aphids, particularly during rainy periods. Possibly this is the same species that

attacked the turnip aphid in Connecticut in 1916, and which was identified as *Entomopthora aphidis* Hoff. by Dr. A. T. Speare of the Bureau of Entomology.

Control Methods.

Spraying with Nicotine Solution. The means advised by the Station and practiced by many growers for immediate relief was to spray the vines with nicotine solution to kill all aphids which are hit by the spray. There are several nicotine preparations on the market, such as "Black Leaf 40," made by the Kentucky Tobacco Product Company, Louisville, Ky.; "Nikoteen," made by the Nikotine Manufacturing Company, St. Louis, Ky.; and "Pratts' Nicotine," made by The B. G. Pratt Company, 50 Church St., New York, N. Y.

One of the best-known of these preparations, and perhaps the one most widely sold in Connecticut, is "Black Leaf 40." This is a heavy liquid containing 40 per cent. of nicotine in the form of sulphate. It will kill most kinds of aphids if diluted at the rate of one teaspoonful in a gallon of water, or one-half pint in a barrel of 50 gallons. If a little soap be added, it will spread and cover the foliage better. For this purpose a piece of soap an inch square to a gallon, or two pounds to a barrel, will answer. For field spraying, therefore, to kill aphids on potatoes, the following formula should be used:

"Black Leaf 40"	1 pint
Laundry soap	2 pounds
Water	50 gallons.

The nicotine solution may be added to Bordeaux mixture, lime-sulphur or lead arsenate, but when used in combination with these materials the soap should be omitted on account of possible chemical changes, forming soluble salts of copper, lime or arsenic, liable to injure the foliage. There was some misunderstanding on the part of the growers regarding the directions contained in the press notice issued on July 16 (See page 291), which reads: "This spray containing soap cannot be applied with Bordeaux mixture but may follow or precede it by a few days." The reason for this statement has already been explained above. Some growers wish to eliminate one spraying, and may do so by adding the "Black Leaf 40" to the Bordeaux mixture, and there is no danger if the soap is omitted.

To kill aphids very thorough work is essential. Most of the aphids are on the tender shoots and on the under side of the leaves, many of which are curled. As the spray will kill only those aphids which are hit by it, it is imperative that a successful spray be directed against the under surface of the leaves and also be thrown against the plant from opposite sides. It is almost impossible to hit all of them by a single treatment. Repeated applications are therefore necessary in some cases. It is extremely important to watch the fields and to begin spraying before the leaves curl, and before the aphids become sufficiently numerous to injure the plants. It will often be found practicable to spray in spots or sections of the field to eradicate or check aphid colonies which later might spread over the whole field, thus forestalling considerable expense and much possible damage.

Clean Culture and the Destruction of Rubbish. As the aphids feed on many weeds, including shepherd's purse, lambs quarters, wild ground cherry, red root pigweed, ragweed, etc., all such weeds should be destroyed both in and around the potato field. As this aphid passes the winter in the egg stage, usually on rose, but often on the stems of weeds, potato vines, etc., all such rubbish should be destroyed, preferably by burning.

Effect of Weather. The weather plays an important part in controlling aphid outbreaks. Heavy rains will doubtless wash many aphids from the tender shoots. Wet weather also favors the growth of fungus diseases, such as *Entomopthora aphidis*. Apparently aphids are apt to be more troublesome in a cold, wet, backward season, and often disappear altogether on the approach of hot weather. The latter, of course, is more favorable to the development of the insect parasites and natural enemies.

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A COCKROACH PEST OF GREENHOUSES.

Pycnoscelus (*Leucophæa*) *surinamensis* Linn.

By M. P. Zappe.

This introduced cockroach was first discovered in Connecticut in the greenhouses of A. N. Pierson, Inc., at Cromwell, on March 1, 1911, by Mr. B. H. Walden, assistant entomologist of this Station. At that time the roaches were present under boards and in cracks but were not very abundant. Mr. Pierson informed him that the insects had been present for several years but that they had done no damage. Little attention was paid to them, therefore, until the spring of 1917, when they had become so numerous that they caused considerable damage in some of the houses by gnawing the bark from the stems of the plants as shown on plate XII, b. After trying to poison the roaches with bait containing arsenic, without much success, Mr. Pierson sent specimens to this Station

and asked for advice in controlling the pest. The specimens arrived on April 30, 1917, and, though immature, they were identified by Mr. Walden as *P. surinamensis* Linn. Mr. Pierson wrote in part as follows:

"They are found chiefly in the rose benches, hiding during the day in the soil. At night they come up, apparently in great numbers, and gnaw the bark of the rose plants about two inches from the surface of the ground, making a clean job of it."

A visit was made to the greenhouses on May 7th, and these insects were found to be very abundant. They fairly swarmed in the loose soil in the corners of the rose benches, and under loose boards, boxes, pails, etc. They had already done considerable damage to newly-set rose plants and to Easter lilies by gnawing the stems. As still greater damage seemed imminent, if the pest was not soon checked, we undertook to carry on a few experiments with stomach and other poisons in order to determine a satisfactory method of control.

As little has been published in this country about this particular species of cockroach and its status as a possible pest, all available information has been incorporated with the notes of our experiments in this bulletin.

Damage and Habits.

The damage done during the spring of 1917 amounted to several hundred dollars in this one house. The owner had just set young rose plants on benches which had been idle for about four weeks. These were immediately attacked by the young roaches (there were very few adults present at this time) and nearly all of them were girdled at the base, as shown in plate XII, b. When the roaches are full grown they climb up the plants and eat the leaves rather than the bark on the stems. Much damage was also done to Easter lilies. Here the young sprouts from the bulbs, as well as large plants, were attacked. On the larger plants the bark was chewed off the main stem, as shown on plate XIII. In another house they were eating the bark of the stems of poinsettias.

These roaches spend the day in the soil in the benches, in cracks in the boards on the sides of benches, under boards, barrels, in cracks and holes in the walls of the building, etc., wherever it is

dark and there is a chance to hide. A trowelful of soil from the corner of a bench would sometimes contain from 30 to 40 young cockroaches. A small board or shingle left on a bench undisturbed for a few days would shelter large numbers of them. During the day the roaches are rarely seen and when some are uncovered they run for the nearest shelter, or crawl down into the soil if possible. At night they come out to feed and the walks and benches are covered with them. When feeding they do not seem to mind the light from a lantern. In the house where the roaches were most numerous, the benches were low, being right on the ground and known as solid benches; the sides were boarded up, and the boards were full of knot holes and cracks, making ideal places for roaches to hide. Most of the roaches were near the sides of the benches where the soil was not too wet, and where it was not packed down as hard as in the middle; they were very seldom found hiding in the center of the benches.

DISTRIBUTION.

The present species is circumtropical in distribution, extending its range frequently into subtropical regions. It is abundant in the peninsula of Florida and the Brownsville region of Texas. It has been found established as far north as Jacksonville, Gainesville and Cedar Keys, Florida; New Orleans, Louisiana, and San Antonio, Texas. Elsewhere in the United States the species has become temporarily established in greenhouses and places similarly heated during cold weather. It has been taken in the reptile house of the New York Zoological Society in New York City; also at Rutherford, N. J., Washington, D. C., and Cromwell, Conn. An immature specimen taken from a bunch of bananas has been recorded from Toronto, Ontario.

Professor A. P. Morse of Wellesley College reported it doing damage in a conservatory at Wellesley, Mass:, in company with the Australian cockroach, *Periplaneta australasiae* Fabr.

Outside of the United States *Pycnoscelus surinamensis* has been taken in* Cuba,[7] Bahama,[6] Porto Rico,[7] Dominica,[2] Trinidad,[1] Barbados,[11] Martinique,[11] Grenada,[11] St. Vincent[11] and Jamaica[11] Islands of the West Indies, Bermuda,[9] Mexico,[11] Costa Rica,[11] Brazil[11] and Guiana[11] on the American continent, Sumatra,[8] Lom-

* Numbers refer to literature at end of this paper.

bok[4] and Java[11] of the East Indies, Philippine Islands,[11] Lower Siam,[8] Singapore, Straits Settlements,[3] Amoy, Southern China,[11] and Senegal, northwestern Africa.[11]

Probable Manner of Introduction.

This cockroach was probably first brought into Connecticut with shipments of plants or fruit from South or Central America, Florida or Texas. Florists have for many years imported palms, ferns, orchids, and various other tropical plants, and thousands of shipments of pineapples and bananas come each year into the northern states.

No official inspection was made of any imported plants entering the State until 1909 when nests of the brown-tail moth were found on fruit stock grown in France. For three years the larger shipments of stock imported by nurserymen were inspected, but doubtless many small shipments were brought in by private owners, and extensive importations made by florists. These were not inspected because there was no way to trace them. In 1912 the Federal Horticultural Board was established, and its system of permits and notices has made it possible to trace all shipments entering the state since that time. All woody, field-grown plants have been inspected but it has not seemed necessary to attempt the inspection of all herbaceous or tender greenhouse plants, and no inspection of fruits has been attempted.

This cockroach must have entered Connecticut at least as early as 1909, and perhaps earlier, and the chances are good that it came in with plants. Nymphs of this species were intercepted at Cromwell, Conn., in the spring of 1915, on a shipment of Araucarias from Belgium, and it has been found in the District of Columbia with plants imported from Straits Settlements. This and other species of cockroaches have been found frequently by horticultural inspectors in the District of Columbia, New York, New Jersey and Connecticut. In many cases the roaches were immature, and the infestation reported under the name of "cockroach," and the species not identified. Most of the roach infestations have been in shipments of orchids, palms, and araucarias. The greatest number of intercepted specimens have come from Colombia 29, Brazil 8, Venezuela 6, Belgium 1, Guatemala 1, Straits Settlements 1, Azores 1, Antiqua, British West Indies 1, and Philippine Islands 1.

SYNONYMY.

1758, *Blatta surinamensis* Linn. 1838, *Panchlora surinamensis* Guer. 1862, *Pycnoscelus obscurus* Scudd. 1865, *Leucophaea surinamensis* Brunn.

Other established synonyms of the present species are:

Blatta indica Fabr. *Blatta melanocephala* Stoll. *Blatta punctata* Eschscholtz. *Blatta corticum* Serville. *Panchlora celebesa* Walker. *Panchlora submarginata* Walker. *Panchlora occipitalis* Walker.

DESCRIPTION.

Female*

Form robust, structure rather heavy. Head flattened, eyes well developed. Maxillary palpi short and stout. Pronotum with glabrous surface showing minute, rather widely separated pits. Wings transparent except in narrow area of the irregular costal veins and distal portion of anterior field where they are translucent. Styles very short, joints much fused, acuminate tip flattened, dorsal surface weakly convex, ventral surface more strongly convex proximad. This species is easily separated from the other common roaches of North America by having the ventral margins of the femora unarmed, or supplied with few distal spines. Head shining, blackish brown; legs brown; tegmina translucent, blackish chestnut brown. Abdomen with dorsal surface dark brown, ventral surface polished, broadly margined with blackish brown, shading into brilliant, suffused cinnamon rufous in large mesal portion. Pronotum shining, blackish brown, with marginal traces of buffy latero-cephalad. General coloration of immature specimens deep chestnut brown to blackish chestnut brown. Head, pronotum, mesonotum, metanotum, median segment, first two dorsal abdominal segments and ventral surface polished, with very minute, scattered microscopic punctae on head and dorsal polished portions. Remaining dorsal portions of abdomen microscopically finely shagreened, showing raised and polished points on third segment and fewer raised points on the remaining segments. Head of general color shading to slightly paler on the occiput. The female is shown on plate XIV, a.

Eggs.

Eggs are often laid in the soil by the females. When first laid they are whitish yellow, later becoming darker. Egg masses are

* From Blattidae of North America, by Morgan Hebard.

slightly curved as shown on plate XII, c, and vary in size, the larger ones being about 10 mm. long and 3 mm. wide. The embryos in the egg mass are well developed before the eggs are laid, and when an egg mass is broken open the young roaches appear to be ready to hatch. The eyes, mandibles and spines on the tibiae are brown and the rest of the body is white. The eggs in each mass vary from 14 to 42 in number, the average being 24.

Egg Laying Habits.

When roaches have been injured, or very much excited, they will often lay an egg mass which as a rule is not very well developed and in the laboratory has never produced young.

A number of adult roaches in a cage were kept at a temperature of about 36° F. for a few days. After a short time they were all on their backs, apparently dead, but when they were removed to a warmer room many of them came back to life and laid quite a number of egg masses. In our experience none of these egg masses or those found in the soil or in the cages have ever hatched. Sometimes a female will eat her own eggs.

Very little is known of the reproduction of this species but from our observations it would seem that normally the young roaches are either born alive or hatch from eggs within 24 hours.

Is the Species Parthenogenetic?

Though the male has been described and occurs in the East Indies, Mr. Hebard* states that he has examined several hundred specimens from the United States, Mexico and the West Indies without finding a single male, adult or immature, from the American continent. Over 1,000 specimens from Mr. Pierson's greenhouses were examined, and all were females. These facts point toward parthenogenesis, but do not prove it.

Control Experiments.

A number of poisons were used in various combinations to control this cockroach, but only a few were found that were of any value at all. Some of them would kill the roaches but not in large enough numbers to pay for the treatment. The object of these experiments was to find a quick and also a cheap way to get rid of this pest. Following is a list of those poisonous baits which

* Ibid. page 196.

under ordinary conditions would hold this insect in check and would be useful in small infestations of this cockroach.

Effective Poison Baits.

PHOSPHORUS PASTE.

This paste is made of flour, glucose, honey, and from 2% to 4% of phosphorus. This comes in two-ounce tubes and may be purchased in nearly all drug stores. The price is 25 cents for a two-ounce tube and would be a very expensive treatment for a large greenhouse. The roaches are very fond of this bait and are easily killed by it. A home-made phosphorus paste was made at the Experiment Station chemical laboratory which worked as well as the commercial paste but it is not recommended for general use. Yellow phosphorus, from which this paste is made, is highly inflammable and must be kept under water. It is, therefore, very dangerous for anyone not acquainted with its properties to handle it. There is also danger from fires if too high a percentage of phosphorus is used in the paste.

BORAX.

This is the next best remedy for this cockroach and has some advantages over the phosphorus paste. It is cheaper, non-poisonous to man, easily handled, and can be used in several combinations. It is slower in its action on the roaches than phosphorus. After eating borax the roaches first lose the use of their legs and may be seen slowly crawling around on top of the soil in the benches or on the walks, and later they die.

A mixture of borax, powdered sugar and cooking chocolate, equal parts of each, ground up together in a mortar and made into a paste with honey and water, was tried and killed many roaches. This was eaten slowly and was not all cleaned up for a week. Dead roaches were found every day and for a few days after the bait was all eaten.

Another formula tried was:

Borax.....4 oz.
Flour.....4 oz.
Bananas.....3.

Three over-ripe bananas, flour and borax were made into a paste and applied to several benches. This was all eaten in a few days and dead roaches found.

A bait made of powdered sugar and borax in equal parts was used with good results. It has the advantage of being easier to mix and apply and is also cheaper than any of the other borax combinations tried. The results were about the same. To a part of this mixture a few drops of anise oil were added to make it more attractive. This was eaten a little sooner than the portion without anise oil. Such was the case whenever anise oil was added to any bait that roaches would eat.

Some of the following poisons were eaten by roaches, and others were not. Those that were eaten were of very little value in holding the insect in check.

STRYCHNINE.

Strychnine.....2 grams.
Wheat bran.....1 pint.
Glucose and water enough to moisten.

The strychnine was dissolved in a little water, the glucose added, and the mixture then used to moisten a pint of bran. Roaches ate this fairly well but very few dead ones were found. This formula was also tried with the addition of a few drops of anise oil with no better results.

Strychnine.....2 grams.
Flour.....1–2 lb.
Sugar enough to sweeten.

This was all eaten and a few dead roaches found.

ARSENICAL POISONS

This species of cockroach seems to be very resistant to the effect of arsenicals. Only a few of the following were eaten at all, and where they were, no dead roaches were found.

Arsenate of lime.....10 grams
Flour.....1–2 lb.
Sugar to sweeten.

All of this was eaten but no dead roaches were found.

Arsenate of lead.....5 grams (dry powdered).
1 over-ripe banana.

This mixture was eaten but no dead roaches were found.

Arsenate of lead, 5 grams, was worked into one-fourth pound of lard. Little red ants began to eat this as soon as it was put down.

The heat in the greenhouse was enough to soften the lard so that it ran all over the paper upon which it was placed. I do not know whether the roaches ate any of this or not, but no dead roaches were seen.

Paris green.....4 oz.
1 Orange
1 Lemon
Molasses.....1 pint.
Middlings.....5 lbs.
Water.....3 qts.

This formula is recommended for cutworms, but proved to be of no value against this cockroach, as none of the mixture was eaten.

White arsenic.....2 oz.
Flour.....1 lb.
Sugar.....2 oz.

These ingredients made into a thin paste with water were left untouched.

On two benches the stems of the rose plants were painted with a thick solution of lead arsenate. These plants were not injured.

Rose branches—parts of plant cut off when pruning—were dipped in a solution of lead arsenate. Leaves and all were partly eaten every night. After the first night the leaves would be wilted and the roaches would not eat any more of this material.

Arsenate of soda.....150 grains
Sugar..... 2 oz.
Beer..... 6 fluid oz.
Water enough to make a pint.

This was used to moisten bran and was placed on benches. I could not tell if this was eaten very much as men watering the plants may have washed most of it into the soil. At this time the men working in this greenhouse used some commercial phosphorus paste at night and many dead roaches were found. Some of these were collected and their stomach contents analyzed by Mr. C. B. Morison of the Chemical Department. He found no trace of arsenic but large quantities of phosphorus. This shows that the arsenic was not responsible for their deaths.

CYANIDE OF POTASSIUM.

Cyanide of Potassium.....1–4 oz.
Flour.....1 lb.
Sugar to sweeten.

Cyanide was dissolved in a little water and mixed with the flour and sugar to make a thin paste. When this was mixed it smelled very strong of cyanide but the next morning it was all eaten. Even the paper upon which it was placed was devoured, big holes being eaten out where the poison touched it, as shown on plate XIV, b. Cyanide, although a very deadly poison, had no apparent effect on these cockroaches and no dead ones were found.

Flour.....1 lb.
Cyanide of Potassium.....10 grams.
Arsenate of lead.....10 grams.
Sugar..... 2 oz.
Water to make a thin paste.

In this case cyanide and arsenate of lead were used together and the mixture was all eaten by the roaches, but no dead ones were found.

Flour.....1–2 lb.
Cyanide.....1–4 oz.
Phosphorus (Red).....1–2 oz.
Glucose.....2 tablespoonfuls
Water to make a thin paste.

This, like the preceding, was all eaten, but did not kill the roaches.

RED AMORPHOUS PHOSPHORUS.

Flour.....1–2 lb.
Red Phosphorus.....1–2 oz.
Glucose.....2 tablespoonfuls
Water to make a thin paste.

The phosphorus used in this formula is poisonous but is not dangerous to handle like the yellow phosphorus. It has the characteristic phosphorus smell and was thought to be a good substitute for the phosphorus paste. The cockroaches ate this bait but it did not kill them.

Lard.....1–4 lb.
Phosphorus (Red).....5 grams.

This was mixed and spread on pieces of paper but the heat in the greenhouse made the lard soft and it began to run. Ants immediately began to feed on this mixture. I do not know whether roaches ate any of this or not but no dead ones were found.

MERCURIC CHLORIDE.

Mercuric Chloride.....10 grams
Flour.....1–2 lb.
Glucose.....1 tablespoonful.
Water to make a soft paste.

This formula was tried, one-half with a few drops of anise oil, and the other without, but the roaches would not eat it.

PLASTER OF PARIS.

Plaster of Paris.....1–2 lb.
Flour.....1 1–2 lb.
Powdered sugar.....1–4 lb.

These ingredients were mixed dry and were placed in shallow flower pots where the roaches could get at it. Dishes of water were placed near the bait, the idea being that the roaches would eat the bait and drink the water, and the plaster of Paris would set in their stomachs, thus killing them. The roaches did not eat any of this mixture but sowbugs did, although no dead ones were found.

REPELLENTS.

Sawdust was moistened with fish oil and sprinkled around the plants where the roaches had been doing the most damage. This kept them away from these plants for a few nights, but when the plants were watered the sawdust was washed away and the mixture lost its usefulness. Sawdust and kerosene was also tried with about the same results as the above except that any roaches that came in contact with the kerosene were killed.

TRAPS.

Large glass jars baited with stale beer were sunk into the benches almost to the level of the soil. These worked fairly well but cannot be considered as effective traps, as the roaches were

not caught in large enough numbers. For small infestations they would perhaps be satisfactory but in this case it was too slow a method of control.

KEROSENE SPRAY.

Our experience with kerosene as a repellent led us to try it as a contact spray. Pure kerosene sprayed along the top and sides of the benches brought out all the cockroaches which were near the sides and surface of the benches. As this is the place where most of the roaches stay during the day, great numbers of them were killed in this way. On one side of one bench, in spraying only four feet in length of the bench, 184 roaches were killed. In one corner of the house where the masonry was broken there were many holes in which the roaches hid during the day. Kerosene was sprayed into these holes and the roaches came tumbling out. When they came in contact with the oil they were all killed and the ground was literally covered with dead roaches.

Kerosene will burn the foliage, so great care must be taken not to get any spray on the leaves of the plants. The owner of the greenhouse used the treatment and so reduced the numbers of the roaches that there was no longer any danger of their doing serious damage to his plants.

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ERADICATING THE LITTLE HOUSE ANT OR PHARAOH'S ANT FROM A DWELLING HOUSE.

By M. P. Zappe.

A serious outbreak of the little house ant or "Pharaoh's ant" was reported by a family in Hartford late in November 1916. This ant had been present in this house for several years but had not caused much annoyance until the summer of 1916. In other years it had confined its activities to the pantry and kitchen, and at the beginning of cold weather would disappear until the following summer. But this year the ants were running all over the house, no part of it being free from them. At this time there were many queens around the house, as well as worker ants. A favorite place was the bathrooms, where they could be seen drinking water and running along the tile floor. There were ants in every room in the house; a few could be found on tables, writing desks, among clean clothing in bureaus, on the floors, walls, etc. The lady of the house had been fighting them all summer and was on the verge of a nervous breakdown. She was willing to do almost anything to get rid of this pest, even threatening to tear the house down.

Naphthalene flakes had been used but its effect was only local, merely driving them out of the room where it was used. The family objected to the smell of naphthalene so it could not be used all over the house. Trapping with a sponge dipped in a sweetened solution, and when full of ants, dropping it into hot water, killed many ants but they soon became suspicious of the sponges, after which very few would venture to go into them.

On December 1, 1916, a poisoned bait recommended by the Bureau of Entomology, Washington, D. C. (Farmers' Bulletin 740) was tried. The formula for its preparation is as follows:

1 lb. ..... sugar
125 grains ..... arsenate of soda
1 qt. ..... water
1 tablespoonful ..... honey.

Dissolve sugar in the water and add the arsenate of soda. Boil until sugar and poison are all dissolved, then add the honey. The addition of the honey is said to make the bait more attractive to the ants. When cool this mixture was used with bits of sponge on small, shallow dishes and two or three dishes placed in each room. The object of this poisoned bait is not only to kill the ants

which collect and carry the sirup back to the nests, but also the young and the queens in the nest which feed on it. In less than two hours after distributing the poison around the house, the ants began to find the bait and large numbers were feeding on it and carrying it back to the nest. Even the queens were seen at this bait. A few days later another batch of bait was made up, but this time either it was boiled too long or too much honey was added. When it cooled it was too thick for the ants to eat readily. On December 6 the same formula was tried again except that only one-half pound of sugar was used. This made a thinner sirup which did not dry and harden as quickly as the sirup made from one pound of sugar. The ants seemed to eat this better than the thicker sirup. At this time there seemed to be fewer ants in the front of the house but just as many in the kitchen, where no poisoned bait was used.

The house was visited again on December 15 and very few ants were found on the first floor. A few were found in the bathrooms of the second floor where they were drinking water from the toilets and washbowls. Oxalic acid has been recommended as a remedy for ants by some writers. This was tried in combination with lard but the lard and acid did not mix, so lard was melted and the acid added. This stayed mixed until cool; then it separated. Ants did not eat any of the mixture.

On December 18 no ants could be found on the first and second floors. Two bathrooms on the third floor had a few living ants and many dead and dying ones were curled up on the floor. A poisoned bait of beef liver (2 oz.) and potassium cyanide (150 grains) was made up by chopping the liver fine and adding the cyanide in a water solution. There were so few ants left that we could not tell whether they ate any of this or not. Early the following spring (March 23) the house was visited again but no ants had been seen in the house since December 18, when the last poisoned bait was used. A recent letter states that the ants have never returned, much to the joy of the family.

A NEW FRUIT PEST IN CONNECTICUT.

Laspeyresia molesta Busck.

On July 11 specimens of peach shoots were received from Mr. C. C. Lawrence of the F. A. Bartlett Company, Stamford, who wrote as follows:

"Am sending you under separate cover some specimens of peach twigs, the terminal shoots of which have been attacked by a small insect. Very possibly this may be due to the peach twig borer but the color of the larva is such as to suggest that it might be *Laspeyresia molesta*, brought over from Japan and reported by Dr. Quaintance. In talking with Dr. Quaintance this spring, he mentioned the fact that it had not been found outside the District of Columbia, Maryland and Virginia. Do you suppose it is this insect?"

The specimens were examined and the letter answered by Mr. Lowry as follows:

"Your letter of July 10th, also the package containing the peach twigs, have been received in the absence of Dr. Britton. The twigs were quite badly crushed and it was possible to obtain only one larva. If you would be so kind as to send us more material in a box, it would be greatly appreciated. As you suggest, the damage is probably caused by the larva of *Laspeyresia molesta*."

Specimens were sent to the Bureau of Entomology by Mr. Lawrence or his firm and the insect was identified positively as *Laspeyresia molesta*. Mr. E. H. Siegler of the Bureau, in company with Mr. F. A. Bartlett, visited several orchards in the vicinity. They found the insect not only in Stamford but also in Norwalk near the border of New Canaan, in the twigs of a bearing peach orchard. Though a nearby nursery was examined, no trace of the insect could be found on nursery stock. The assistants engaged in inspecting nurseries were instructed to be on the watch for this pest, but they did not find it anywhere during the progress of their work.

As this insect is new to Connecticut, and was described in 1916 as being new to science, a brief account of it is given here, taken chiefly from Quaintance and Wood.* The following description from their paper is reproduced here:

Full Grown Larva. "Thirteen to fifteen mm. long; whitish suffused with pink; tubercles minute, black. Head light brown with darker brown markings; hind margin, ocellar area, and the tips of the trophi black. Thoracic shield light yellow, edged with brown. Spiracles small, circular, dark brown. Anal plate blackish fuscous. Legs and prolegs normal."

* Journal of Agricultural Research, Vol. VII, page 373, November 1916.

The adult has a wing-spread of about half an inch, and belongs to the family Tortricidae. The following is the original description by Mr. Busck:

Adult. "Head dark, smoky fuscous; face a shade darker, nearly black; labial palpi a shade lighter fuscous; antennae simple, rather stout, half as long as the forewings, dark fuscous with thin, indistinct, whitish annulations. Thorax blackish fuscous; patagia faintly irrorated with white, each scale being slightly white-tipped. Forewings normal in form; termen with slight sinuation below apex; dark fuscous, obscurely irrorated by white-tipped scales; costal edge blackish, strigulated with obscure, geminate, white dashes, four very faint pairs on basal half and three more distinct on outer half besides two single white dashes before apex; from the black costal intervals run very obscure, wavy, dark lines across the wing, all with a strong outwardly directed wave on the middle of the wing; on the middle of the dorsal edge the spaces between three of these lines are more strongly irrorated with white than is the rest of the wing, so as to constitute two faint and poorly defined, white dorsal streaks. All these markings are only discernible in perfect specimens and under a lens; ocellus strongly irrorated with white, edged by two broad, perpendicular, faint bluish metallic lines and containing several small, deep black, irregular dashes, of which the fourth from tornus is the longest and placed farther outward, so as to break the outer metallic edge of ocellus; the line of black dashes as well as the adjoining bluish metallic lines are continued faintly above the ocellus in a curve to the last geminate costal spots; there is an indistinct, black apical spot and two or three small black dots below it; a thin but distinct, deep black, terminal line before the cilia; cilia dark bronzy fuscous. Hind wings dark brown with costal edge broadly white; cilia whitish; underside of wings lighter fuscous with strong iridescent sheen; abdomen dark fuscous with silvery white underside; legs dark fuscous with inner sides silvery; tarsi blackish with narrow, yellowish white annulations."

Injury.

The larvae have been found injuring the twigs not only of the peach, but of the plum and cherry, and also the fruit of the peach. In one orchard between 80 and 90 per cent. of the twigs had been injured, and adjacent nursery stock showed even a higher percentage of injury. This injury begins soon after new growth starts in spring and continues until growth ceases in the fall. The larvae seem to prefer the tender growing shoots, and may pass from one into another. Thus one larva may tunnel and injure several shoots. The injury to twigs closely resembles and is scarcely distinguishable from that caused by the common

peach-twig borer or peach moth, *Anarsia lineatella* Zell. Apparently the peach is preferred to the plum and cherry. This twig injury checks growth and on the peach is followed by an exudation of gum; it is more serious in a nursery than on bearing trees.

Though considerable injury results from the attack to the twigs, it is the attack on the fruit of the peach which causes the greatest damage. The larvae eat through the skin near the stem, beginning their attack on the green fruit, but as the fruit approaches maturity it becomes more seriously infested. Ripening peaches often have several larvae in a single fruit, and following the mutilation, brown rot finishes the destruction. The larvae will also enter the fruit at other places, especially if damaged by hail or punctured by curculio. Many of the infested peaches fall to the ground, but some will hang upon the tree. Since this article was written it has been discovered that the larvae infest not only peach but also the fruit of apple, pear and quince.

Life History.

The winter is passed by the full-grown larva on the tree, probably making winter cocoons in the cracks of the bark or in cavities eaten into the bark on the twigs. Early in the spring the larva enters the pupa stage. In summer, cocoons are sometimes made in the cavity at the stem end of the fruit. The cocoon is made of whitish silk. There are probably two or three broods of larvae each year. The adults emerge and begin to lay eggs soon after growth starts on the tree, as larvae have been observed at work on the twigs when the new shoots were from six to eight inches long. Thus the larvae begin early in the season and they are found in different stages at work on the twigs until late in the fall.

Possible Control Measures.

It is too early to recommend control measures, as experiments have not yet been conducted to determine the best methods of treatment. Only a few possible measures can be pointed out here. The cocoons and larval cases are so close and impervious that fumigation with hydrocyanic acid gas does not seem to be a satisfactory remedy. Possibly dipping the trees in a miscible oil may prove more effective. This can easily be carried out when the trees are dug for shipment.

In the bearing orchard early spraying with lead arsenate soon after the fruit sets will probably reduce the injury to the fruit, as in the case of the codling moth which attacks the apple.

The larvae tunnelling in the twigs are mostly out of the reach of arsenical poisons. Clipping off the twigs in winter—a customary practice in heading back orchard trees—will undoubtedly remove a small percentage of the larvae. These twigs should be gathered and burned before the trees start into growth.

THE FALL WEB-WORM.

Hyphantria cunea Drury.

Nearly every year in the latter part of the summer nests of the fall web-worm are present on orchard, shade and woodland trees throughout the State. These are more prevalent in some seasons than others, and it is, of course, when most abundant that the insect is the most destructive. In 1901, the fall web-worm was exceedingly prevalent. It continued to be abundant through 1902 and 1903, though diminishing somewhat. From then until the present, the nests have not been rare, though not sufficiently common to receive particular mention in the annual report of this Station. In 1916 this insect was noticeably more common than for several years preceding, and in 1917 it was probably more prevalent than since 1902. As no adequate account of this insect has ever been published in this series of reports the present paper was prepared to supply the want.

Relationship to Other Insects.

The fall web-worm is the larva of a moth belonging to the family Arctiidae or tiger moths. Most writers consider it to be *Hyphantria cunea* Drury, but some recognize it as *H. textor* Harr., while others consider the two species as identical, *textor* being a synonym, or possibly a variety of *cunea*. The Station collection contains one adult specimen labeled *textor*, and all others are labeled *cunea*. The writer has made no attempt to separate the two species. For the purposes of this article it really makes no difference. In Smith's List of Lepidoptera, 1st edition, published in 1891, *textor*, *punctatissima* and several other names are given as synonyms of *cunea*. In the 2nd edition, published in 1903,

and also in Dyar's List of Lepidoptera, published in 1902, *cunea* and *textor* are given as separate species. In the recent Check List of Lepidoptera by Barnes & McDunnough, they are also given as distinct species.

Dr. E. P. Felt* states that "the web made by the larva of the more common species in this state (New York) belongs to *Hypantria textor* Harris" and that *cunea* may also occur "but appears to be rarer than the other species." In Banks' Index of American Economic Entomology, the references are given under *cunea*. As most of the references in literature have been given under the name of *cunea*, this name is used in the present paper.

Injury and Habits.

The caterpillars injure trees of nearly all kinds by feeding upon the leaves, often defoliating them. The nests or webs usually occur on the ends of the branches. In this respect the fall web-worm differs from the tent-caterpillar (with which it is sometimes confused), which makes its nests in the forks of the main trunk or branches. The latter insect makes its nests in May and those of the fall web-worm appear in July, August and September. Moreover the tent-caterpillars go out of their nests to feed, and the fall web-worms always feed inside their nests, as shown on plate XVII, b. When the leaves have been eaten, they extend their nests to include fresh leaves and proceed to devour them. In this way the nest may become so large as to involve the whole branch. All caterpillars hatching from a single egg-cluster probably live and feed together in one nest.

When fully grown the caterpillars leave their nest and crawl about seeking a place to transform. They are then from one to one and one-half inches in length and are covered with brownish hairs. The hickory tree shown on plate XVIII was entirely defoliated by fall web-worms in New Canaan in 1901.

Food Plants.

Some years ago the Bureau of Entomology of the U. S. Department of Agriculture at Washington, D. C., compiled a list of food plants containing 120 different kinds of trees, shrubs and plants, upon which the caterpillars feed. This includes nearly

* Insects Affecting Park and Woodland Trees, i. page 143, 1905.

all the fruit, shade, ornamental, and native woodland trees. Pear, apple and cherry are commonly attacked. Elm, willow, poplar, hickory, black walnut, black cherry, choke cherry, ash, box elder and hackberry are common food plants, often being wholly or partially defoliated. We may therefore expect to see this insect on almost any kind of tree or shrub grown in the State.

Number of Broods.

There is usually but one brood each season in Connecticut, the caterpillars appearing in late summer. In 1904, the writer observed one of the nests in New Haven, June 23, and rearing adults, found that they laid eggs and that a second brood of caterpillars had hatched by August 15. These caterpillars were fed until nearly full grown, but as all members of the staff were obliged to be away inspecting nurseries, they were not fed and all died from starvation before transforming. This indicates that the fall web-worm is partially double-brooded in Connecticut. Since 1904, an occasional nest has been noticed in early summer, but most of them are seen later in the season.

Beutenmüller* states that this insect is double-brooded in the vicinity of New York City, and Smith† records two broods as being normal in New Jersey. According to Dr. Howard,‡ there are two broods in Washington, D. C. On the other hand, Fernald has studied the life history of this insect carefully in Massachusetts and finds only one annual brood in that latitude.

Life History.

The adult female lays on the under side of a leaf a cluster containing between 400 and 500 eggs. This cluster is shown on plate XVI, b. The eggs hatch in about ten days and the caterpillars feed gregariously and form a nest on the end of the branch. In about six weeks they become full-grown and pupate under rubbish, or attached to fences, tree trunks, etc., in light-brown cocoons covered with the hairs from the caterpillars. The principal or late brood passes the winter in these cocoons. Where

* Bulletin, American Museum of Natural History, Vol. X, page 376, 1898.

† Insects of New Jersey, page 439, 1909.

‡ Farmers' Bulletin No. 99, U. S. Department of Agriculture, page 20, 1899.

there are two broods the adults emerge in May, but in the north where the insect is normally single-brooded the adults do not appear until July. Where double-brooded, the first-brood caterpillars transform to pupae about July 1st and the adults emerge about a month later.

Description.

Egg. 0.55 mm. in diameter, globular. Surface finely sculptured or pitted. Light green or yellow when first laid, changing to a lead color before hatching. Laid usually on the under side of a leaf in a cluster containing from 400 to 500 eggs, covered with whitish hairs from the body of the female.

Larva. When first hatched, pale yellow with two rows of dark tubercles along the back, these tubercles bearing hairs. When fully grown from 30 to 35 mm. in length; color variable. Mostly striped with dark brown or black and yellow. Some individuals are nearly solid brown, some nearly black, while others are gray or lead color. There are two rows of black and orange dorsal tubercles bearing hairs which are mostly light brown but some are nearly black and others white. These tubercles are really part of a series of transverse rows, one row being borne on each segment, and, except ventrally, surrounding it. The tubercles all bear hairs nearly uniform in length, giving the caterpillar a distinctly hairy appearance. Head and legs vary from light brown to black.

Pupa. 8-10 mm. long, brown, with a more or less distinct swelling near the middle and with the spiracles showing as projections along the sides. Enclosed in a thin, light gray cocoon, in which larval hairs and particles of dirt are mixed. The cocoons are usually formed in clusters in the crevices on trunks of trees, underneath fences, rubbish on the ground, etc.

Adult. Wing-expanse 25-35 mm. Front and rear wings white, the front wings either pure white or more or less well-marked with black spots. In the most prominently marked specimens these spots form six curved transverse rows; this form has been described as *punctatissima*. The immaculate form has been described as variety *budea* Hübn. There are all gradations between these two forms. The rear wings often have one or more black spots but many are immaculate. Femora yellow, tibiae black. Eggs, adult and small larvae are shown on plate XVI.

Parasites and Natural Enemies.

No doubt some of the birds, like cuckoos, shrikes, etc., which commonly attack hairy caterpillars, feed upon the fall web-worm. Perhaps the most important natural enemies are the four-winged or parasitic flies belonging to the order Hymenoptera. Of these, three of the most important are *Apanteles hyphantriæ* Riley, *Meteorus hyphantriæ* Riley, and *Campoplex (Limneria) pallipes* Prov. An egg parasite, *Telenomus bifidus* Riley, is said to sometimes destroy nearly all eggs in the cluster. In addition to the parasites mentioned above, the following have been reared from this or some other species of *Hyphantria*: *Campoplex fugitivus* Say, *Apanteles lacteicolor* Viereck, *Pteromalus (Dibrachys) boucheanus* Ratz., *Syntomosphyrum esurus* Riley and *Eremotylus glabratum* Say. A dipterous parasite of the family Tachinidae, genus *Tachina*, has been recorded by Dr. C. V. Riley*, who states that this fly is fully as useful as any of the other insect parasites.

In addition to the parasites, there are several predaceous insects that devour the larvae. These include the soldier bugs, *Euschistus servus* Say and *Podisus maculiventris* Say, in the Southern States the praying mantis, *Stagmomantis carolina* Linn., and the wheel bug, *Prionidus cristatus* Linn., and the larva of a Carabid beetle, *Plochionis timidus* Hald. The adult moths are eaten by various species of birds, spiders, dragonflies, robber flies, and the large ground beetle, *Calosoma scrutator* Fabr.

In Kentucky in certain years the caterpillars are killed by a fungus, *Empusa gryllii* Fres.

Control Methods.

There are two common methods of controlling this insect on orchard and shade trees, but in the woodlands there has been no attempt to combat it. On small trees that can easily be reached, it is a simple matter to clip off and burn the nest when first formed and small, before the tree has been injured. Tree pruners can be used for this purpose on larger trees. It is also feasible to kill the caterpillars in their nests on the tree by means of a torch. This will not seriously injure the tree as might be

* Bulletin No. 10, Division of Entomology, U. S. Department of Agriculture, page 52, 1887.

the case with the tent-caterpillar, where the nests are in forks of the branches. Fall web-worm nests are at the ends. The use of the torch will scorch some of the nearby leaves as well.

Spraying with lead arsenate, using at least three pounds of the paste (or one and one-half pounds of the powdered or dry form) in a barrel containing fifty gallons of water, will prevent any serious or marked defoliation of the tree. This is, of course, the method generally practiced in Connecticut orchards, which need to be sprayed systematically in order to obtain good fruit. Shade trees can also be sprayed, and are sprayed in many Connecticut towns and cities. The expense of spraying woodland would be prohibitory. Certain small areas are sprayed each year in gipsy-moth infested regions in the eastern part of the state, and of course the spraying effectually controls the fall web-worm.

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THE HICKORY TUSSOCK MOTH, *HALISIDOTA CARYAE* HARRIS, AND OTHER CLOSELY ALLIED SPECIES.

The report of this Station for 1907, contained on page 332 a brief notice of the hickory tussock moth, and illustrations were given on plate XV. During the past ten years this insect has had its ups and downs, but in 1917 it seemed to be more abundant than for many years. Late in the summer the caterpillars were seen crawling about on walks, fences, trunks of trees, etc., seeking a place to pupate. Associated with the hickory tussock moth caterpillars were the caterpillars of the white-marked tussock moth and many larvae of the tessellated tussock moth, *Halisidota tessellaris* S. & A. The latter is not as common normally in Connecticut as *caryae* but in some localities in 1917 it approached it closely in abundance. The larvae of both species are shown on plates XIX and XX. Plate XX, c, shows the cocoons, probably of both species, on the trunk of a sugar maple tree growing along one of the streets in New Haven.

These tussock moths belong to the family *Arctiidae* and are closely related to the fall web-worm described on page 322 of this report. There are three species in Connecticut: *Halisidota caryae*, *H. tessellaris* and *H. maculata*. Though the first two are fairly common, *maculata* is rather rare about New Haven but is said to occur more abundantly farther north. *Maculata* feeds on willow, poplar, alder and oak; *caryae* feeds on oak, elm, maple, hickory, walnut, poplar, willow, ironwood, hornbeam, chestnut, linden, locust, apple, cherry, larch, etc.; *tessellaris* is known to feed upon maple, oak, elm, beech, June berry, locust, hornbeam, hickory, walnut, ash, sycamore, witch-hazel, huckleberry, chestnut, willow, poplar, tulip tree, sweet gum and linden. It will be seen from the list given above that these tussock moths are somewhat general in their feeding habits and it would not be strange to find them devouring almost any kind of foliage.

The adults of all three species appear in June and July and the females lay their eggs on the under side of the leaves of their host trees. The hickory tussock moth deposits eggs in a patch about an inch broad. The young larvae feed gregariously at first and greatly resemble those of the fall web-worm, but as they increase in size they take on characteristic markings with each moult. Next to the last instar, they are covered with white hairs prettily

ornamented with black spots, and with two pencils of black hairs near each end of the body, as shown on plate XIX, b. In the last caterpillar stage, just before pupation, there is a continuous black stripe along the back with the black pencils as described above. The caterpillar is then about one and one-half inches long, and is shown on plate XIX, b.

The caterpillar of the tessellated tussock moth varies from gray to yellow, and does not have such a prominent black stripe along the back. On the second segment back of the head, there is on either side a lateral black pencil with two white ones under it. On the third segment there is a similar black pencil with one white one under it. This larva is about one and one-fourth inches long and is shown on plate XX, b.

The adults of both species are about the same size, and have a wing-expanse of about two inches. *Caryae* has light brown fore wings marked with silvery white spots; rear wings nearly white, being light brown or yellowish. Body buff or light brown. *Tessellaris* has both wings of nearly the same color, light brown, semi-transparent. The fore wings are marked transversely with inconspicuous blocks of darker color; rear wings without markings. Body buff or light brown. *Maculata* resembles *caryae* but has light brown instead of white markings on the fore wings.

The cocoons are ash gray and are formed on the trunks of trees, sides of buildings, fences, walls, etc. There is only one brood each year and the winter is passed in the cocoon.

A description of all stages, and illustrations of the white-marked tussock moth (*Hemerocampa leucostigma* S. & A.) will be found in the Report of this Station for 1916, page 105.

Wherever these tussock moths become so abundant as to defoliate trees, the remedy is to spray with lead arsenate, using three pounds of the paste in fifty gallons of water. Properly sprayed orchards will not be injured. In addition to spraying with poison, the caterpillars can be killed when found, and the cocoons can be removed from the trunks of trees during the winter months.

THE WALNUT CATERPILLAR.

Datana integerrima Gr. & Rob.

This caterpillar feeds in clusters on black walnut, butternut and hickory, often defoliating trees, and was particularly abundant

in the State in 1917. It has been mentioned in preceding reports of this Station as follows: 1901, page 275 (brief note); 1905, page 257 (bare mention); 1906, page 298 (bare mention); 1914, page 191 (brief note with one illustration); 1916, page 140 (brief note). The purpose of this article is to give a more exte ded account of the insect so that property owners and caretakers will recognize it. Several times this insect has been reported to the Station as being the gipsy moth.

On August 16, the entomologist was called to Clintonville, where several black walnut and hickory trees were being defoliated. One large black walnut was about half stripped and the leaves were fast disappearing. Nearly every branch contained one or more clusters of caterpillars, all eating away on the leaves. A small tree of the same kind nearby had been wholly stripped. Hickory trees along the road not far away were also infested, some branches being then denuded.

Caterpillars were received on black walnut from Meriden, August 10; East Haven, August 13; Wethersfield, August 29; and on hickory, Wethersfield, August 30.

The caterpillars are gregarious and may be seen feeding in clusters near the ends of the branches. When full grown they are about two inches long, black, and covered with whitish hairs. The appearance of a single caterpillar is shown on plate XXI, b. Just before pupating the caterpillars separate and crawl up and down the trunks of the trees and along the ground. One often sees them crossing the highway and wonders where they are going; probably either seeking more food or a place to pupate.

Before reaching maturity these caterpillars have the habit of congregating in masses on the trunk or larger branches for the purpose of moulting. The discarded skins remain on the tree making a patch of fur, as shown on plate XXI, d. All larvae of the genus *Datana* are gregarious, and when disturbed elevate their heads and tails in a characteristic and peculiar manner, as shown on plate XX, d. The chrysalid is a naked brown pupa formed in the ground where the species passes the winter. There is only one brood each year.

The adult is a tan-colored or reddish-brown moth with a wing-spread of about two inches. The forewings are crossed with more or less distinct lighter and darker bands. A patch on the thorax is of a beautiful and brilliant mahogany red. The adult, natural size, is shown on plate XXI, a.

Though this insect is not of tremendous economic importance, it is conspicuous and people wonder what it is. Moreover, it works very rapidly and the trees attacked are soon stripped; but this stripping, coming as it does so late in the season, does not seriously impair the vitality of the trees, which may put out leaves the next season as if nothing had happened. Of course it makes the trees unsightly and if followed year after year would soon weaken, and perhaps finally kill them.

Spraying the foliage with lead arsenate at the usual strength will prevent injury or will kill the caterpillars which feed upon the leaves.

The caterpillar is parasitized by a small, four-winged fly, *Meteorus communis* Cresson.

As these caterpillars are conspicuous and feed in clusters on the branches, they can easily be removed and destroyed, especially on small trees within reach of the ground. The masses of moulting caterpillars can also be crushed.

THE YELLOW-NECKED CATERPILLAR.

Datana ministra Drury.

Closely allied to the walnut caterpillar, but differing from it by being more distinctly yellow and striped, is a species common on apple, especially young trees, in August and September, known as the yellow-necked caterpillar, *Datana ministra*. This caterpillar, like the walnut caterpillar, feeds gregariously, each egg-cluster hatching into a colony. The caterpillars continue to feed together until they strip their branch or tree and seek more food, or until they moult or transform to the pupa stage.

The yellow-necked caterpillar was very abundant in 1917, and we found colonies in nearly every nursery where apple stock is grown. In newly-set orchards, it always appears and alarms the owner by proceeding to strip some of his choicest trees. It occasionally feeds upon other kinds of trees. Thus on August 9, we received specimens on cherry from New Britain; on apple from Southbury, August 10; Durham, August 15; New Haven and Hamden August 16, on willow, Stonington, September 10. Assistants from this office observed it in Ellington, Manchester, Durham, Wallingford, New Haven, New Canaan, and probably in many more towns when inspecting nurseries.

When fully grown the caterpillar is about two inches in length, striped lengthwise with yellow and black, the stripes being nearly equal in breadth, except for a broader black stripe along the back. Head and legs black and shining. An orange-yellow cross band next the head doubtless gives this caterpillar its name. The body is sparsely covered with rather short and weak light-colored hairs; it does not have the distinctly hairy appearance of the walnut caterpillar nor does it leave hairy patches on the trees where moulting takes place. Like the walnut species, however, when disturbed it elevates head and tail and would thus be recognized as a *Datana*. The adult closely resembles that of the walnut caterpillar and only specialists can separate them. Larvae and adults of both sexes are shown on plate XXII. There is only one generation each year, and it is as a cocoon in the ground that it passes the winter. Apparently this species is not strongly parasitized but *Apanteles lacteicolor* Viereck and *Heteropelma datanæ* Riley have been reared from *Datana* and may be expected to attack it.

What has been said of injury and control measures relating to the walnut caterpillar applies also to this species, except that on one's pet apple trees in the orchard the caterpillars are sooner noticed, and the discovery is made with greater alarm. But here, also, as it is chiefly young trees that are attacked, it is easier to remove and destroy the colonies. Spraying also would be easier on young and small trees. By no means should young orchard trees be allowed to become stripped. In order to make a good orchard, all trees should be kept free of pests and constantly growing and thrifty. Stripping will check their growth if it does not greatly weaken them, and to permit it is indefensible. All such trees should be sprayed each year with lead arsenate, and a close watch should also be kept, and if a colony of these caterpillars be noticed, drop all other work until the pest has been eradicated.

THE RED-HUMPED CATERPILLAR.

Schizura concinna S. & A.

Belonging to the same family (Notodontidae) as the walnut caterpillar and the yellow-necked caterpillar, but to a different genus, is another peculiar and characteristic defoliator of young

apple trees in late summer, known as the red-humped caterpillar, *Schizura concinna*. This name was given it because the prominent fourth segment from the head is bright coral red in color, as is also the head. The body of the caterpillar is narrowly striped lengthwise with orange, brown and white. Nearly all the segments bear short and rather stout black spines or protuberances projecting upward on the back. These are longest in the vicinity of the "hump" or fourth segment. Length about one and one-half inches.

The adult moth has a wing-spread of about one and one-half inches. The female is not conspicuously marked but both front and rear wings are grayish brown, the fore wings shading costally into a lead gray with small apical black spots. The male is much more prominently marked, the fore wings being brown and cream, with a shading of gray on the front margin, especially near the apical spots. The rear wings are cream with a black spot near the anal angle. Body of both sexes gray. Both larvae and adults are shown on plate XXIII. There is one generation each year, the insect hibernating in a slight cocoon under rubbish on the ground. This insect is perhaps less common than the yellow-necked caterpillar, and though it feeds gregariously, the caterpillars do not form such conspicuous clusters on the twigs. They do not elevate their heads when disturbed, like *Datana*, but their tails are elevated all of the time when they are feeding and crawling about. Like the yellow-necked caterpillar, this species is found upon young apple trees in nurseries and in newly-set orchards, but is by no means confined to the apple. It may feed upon almost any plants of the family Rosaceae.

The caterpillars are parasitized by an ichneumon or four-winged fly, *Campoplex* (*Ameloctonus*) *oedemisiae* Ashmead, which was reared in Connecticut from larvae collected at New Canaan, September 22, 1905, by B. H. Walden. Parasitized larvae are shown on plate XXIII, b. Spraying with lead arsenate is the remedy unless destroying by hand can be practiced.

SOME INSECTS INJURING STORED FOOD PRODUCTS IN CONNECTICUT.*

The importance of growing more food for the people of this

* This paper was published as Bulletin 195, and distributed in August. It is here reprinted with appropriate emendations.

country cannot be over-emphasized, and the various efforts along this line and the publications giving information regarding methods are all praiseworthy. Nevertheless, it is perhaps equally important to conserve the food supplies already grown and stored. It has been estimated that insects take an annual toll of about five per cent. of the value of the stored food products, amounting to $200,000,000.00 each year, in the United States. Most of this loss is wholly preventable if attention is given the matter at the right time, and there is no time when control methods can be enforced with greater profit to the owner, or with greater benefit to our country and to mankind than the present.

The object of this paper is to place before the people of Connecticut a brief account of the principal insects attacking and injuring stored grains and food products in the state, and to suggest methods of controlling them. The accompanying plates are for the purpose of illustrating the text and of giving an idea of the general appearance of the insects.

These insects belong in two large natural groups: the Beetles (Coleoptera) and the Moths (Lepidoptera). The principal features of each are given to enable the reader to identify the species, but as control measures are similar for all, information on this point is given in a separate chapter on page 339 of this report.

THE GRAIN BEETLES.

The Common Meal Worm, *Tenebrio molitor* Linn.

In and around the bottoms of bins and barrels where corn meal, flour, or other cereals are stored, one often finds yellow larvae about an inch in length and resembling wire worms. These feed upon the meal and are called meal worms.

The adult is a shining, black or dark brown beetle, somewhat more than half an inch in length, with thorax rather finely punctured and wing-covers longitudinally striated or grooved. The beetle lays its white eggs in the meal, usually in masses, with a juice or sticky material which causes the meal to adhere to the eggs. The eggs hatch in about two weeks and the larvae feed upon the meal for three months or longer before pupating. The pupal stage requires about two weeks, and normally there seems to be but one generation each year. The adults mostly emerge

in the spring, but where the meal is stored in the house, or in a heated building, they may appear at any time of the year. This insect is shown on plate XXIV, b.

THE DARKER MEAL WORM, *Tenebrio obscurus* Fabr.

This insect is much like the preceding except that the larvae are darker in color and the adult beetles are dull instead of shiny. The life history and injuries are similar and both often occur in the same place.

The treatment is also the same for both species, viz.: fumigating with carbon disulphide or heating the meal in an oven for a short time.

THE CADELLE, *Tenebrioides mauritanicus* Linn.

The larva of this beetle is dirty-white, with head, prothorax and tip of abdomen dark brown, and when fully grown it measures about three-fourths of an inch in length. It has the habit of tunneling into wood to make its cocoon, at least when soft pine is available. The pupa stage evidently lasts three or four weeks.

The adult beetle is brown and shiny, and about three-eighths of an inch long. It lays white eggs which are a trifle over a millimeter long and one-fourth as thick.

There is a single generation annually, and the cadelle feeds on various kinds of stored foods and plant products and is also partially predaceous, as Chittenden* states that both larvae and adults attack and destroy other grain insects which they encounter. Nevertheless, the cadelle is capable of causing considerable injury and the treatment is the same as for the other meal worms. The larvae of the cadelle have been reported from many unexpected places, such as in sugar, in bottles of milk, in powdered hellebore, and boring through the parchment paper of jars of jams and jellies. In some of these places they probably occurred accidentally. Larva and adult are shown on plate XXIV, d.

THE PEA WEEVIL, *Bruchus pisorum* Linn.

The adult beetle is about one-fifth of an inch long, and the wing covers are marked with small black and white spots. It

* F. H. Chittenden, Farmers' Bulletin No. 45, U. S. Department of Agriculture, page 19, 1896.

lays eggs singly on the outside of the green pods in the field, and the larva tunnels through the pods and into one of the green peas. The insect does not mature until the peas have ripened and have been harvested and placed in storage. Then it is common to find a single round hole in a pea where the adult has emerged. Sometimes nearly every pea has a hole in it, and many larvae are unquestionably cooked and eaten in green peas; but the insect does not go on breeding in dry stored peas, there being only one brood each year.

The pea weevil is more serious in the Middle Atlantic than in the Northern States, but it is present in Connecticut. In the Southern States it is claimed that late planting brings comparative immunity from attack but in the writer's experience late planted peas seldom produce a satisfactory crop here. Hence it is better to treat the seed soon after harvesting, and to make allowance in planting for a certain percentage of injured seed. This insect is shown on plate XXIV, e.

The Common Bean Weevil, *Bruchus obtectus* Say.

This is probably the greatest enemy of beans in Connecticut, and though in size somewhat smaller than the pea weevil and resembling it in color and markings, it differs from it by continuing to breed in the dry, stored seed. There are six generations annually in the District of Columbia, and a smaller number in the northern states. Stored beans are often entirely destroyed, or at least rendered unfit for planting, or as food for man or beast. The beans often have several holes in each where the adults have emerged, and as many as 28 have been found in a single seed. Severely weeviled beans are almost useless for planting, but the good seed may be separated from the infested seed by throwing into water. The injured seed will float and may be discarded. This beetle and its work are shown on plate XXV.

The Four-Spotted Bean Weevil, *Bruchus quadrimaculatus* Fabr.

This species is somewhat more slender than the preceding and has different markings. Its habits and life history are similar and the same control methods may be practiced.

The Drug Store Beetle, *Sitodrepa panicea* Linn.

Of all the insects attacking stored food products, perhaps none is more cosmopolitan or feeds upon a greater number of different kinds than the drug store beetle. It is a common pest of all kinds of stored vegetable foods and may be found in breakfast foods, or the dried roots, stems, bark, and seed capsules commonly called spices. It feeds also on the parts of plants used as drugs, often eating those which are bitter and poisonous to man. It has been recorded as attacking forty-five different drugs. It is now distributed throughout the civilized world, and four or five generations may occur in a year, especially in a heated building.

The beetle is about one-tenth of an inch in length, covered with a silky pubescence, and reddish-brown in color. The wing-covers are longitudinally striated and the antennae terminate in three long segments forming the so-called "club." The larvae are white, with dark mouth parts, and assume a curved attitude when at work in their burrows. The adult is shown on plate XXIV, a.

The Confused Flour Beetle, *Tribolium confusum* Duv. and The Rust-red Flour Beetle, *Tribolium ferrugineum* Fabr.

The confused flour beetle has been known to occur in this country for nearly twenty-five years and has caused injury throughout the land. It attacks seeds, stored cereals and other starchy foods and drugs, and is a pest in flour and grain mills.

The adult is a flattened brown beetle, less than a sixth of an inch in length. There may be as many as four generations annually in a heated storehouse.

The rust-red flour beetle closely resembles the preceding, but is not nearly as common in Connecticut. It is a pest in the Southern States and is often shipped north in rice or other starchy food products.

The Saw-toothed Grain Beetle, *Silvanus surinamensis* Linn.

One of the most common beetles in grain and stored food products is the saw-toothed grain beetle. It is less than an eighth of an inch long, flattened, grooved longitudinally, with teeth-

like projections on the sides of the thorax, and brown in color. The larva is white, extremely active, and makes its pupa case on some convenient surface by joining together particles of the infested material with some adhesive substance which it secretes.

There are probably four or five generations each year, and the beetles eat through paper bags and pasteboard boxes to reach foodstuffs inside. Though perhaps preferring farinaceous foods, this beetle often infests fruits and almost all kinds of stored food products. This beetle and its injury to corn are shown on plate XXVII, a and c.

A flat, smooth, reddish-brown beetle, still smaller than the preceding, is occasionally found infesting wheat bran or other cereals. This is *Læmophlæus pusillus* Schr., one of the minor pests but nevertheless capable of causing much injury.

The Granary Weevil, *Calandra granaria* Linn.

Both this weevil and the following belong to the family Calandridae or snout beetles. The adult is a shiny reddish-brown snout beetle nearly an eighth of an inch in length, with a long proboscis. The larva is a legless grub. Both adult and larva feed upon the kernels of the grain. There are four or five generations each year in the vicinity of Washington, D. C., and more farther south. It attacks and injures maize and all of the small grains.

The Rice Weevil, *Calandra oryzae* Linn.

This species resembles the preceding except that it is dull brown instead of shining, and the thorax is more densely pitted. There are four more or less distinct red spots on the wing-covers. This insect is often found in the field and takes its name from the rice which it infests. Its habits and life history are otherwise similar to the preceding. It is shown on plate XXIV, c.

THE FLOUR AND MEAL MOTHS.

The Indian Meal Moth, *Plodia interpunctella* Hubn.

Considerable damage is done each year in mills, granaries, seed warehouses, etc., by the Indian meal moth, which is also a common pest of the household, as it attacks nearly all kinds of

vegetable food products. Each year some food material infested by this insect is brought to the writer's attention. In 1905 some large seed warehouses near New Haven were found infested, and one room was fumigated with hydrocyanic acid gas. This treatment killed the larvae crawling about, and those at work near the outside of the bags, and at first seemed to be effective. Later, however, living larvae appeared from inside, showing that the gas did not penetrate far into the mass of grain.

The larvae web together the grain and flour, especially around the outside. One 100-pound bag of corn was emptied and seven pounds adhered to the bag. The kernels were eaten at the embryo, and are shown on plate XXVII, d.

The eggs are small, white, and laid singly or in groups, and each female may lay as many as 350. The larva is whitish, and spins a silk thread wherever it feeds and travels, and the web

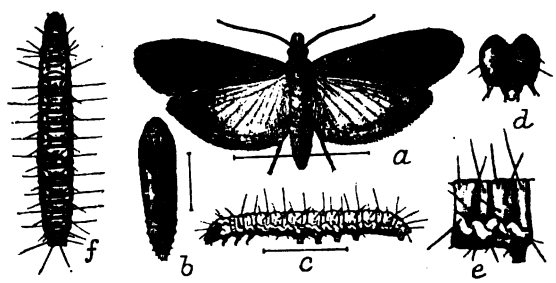

Figure 4. Indian meal moth. *a*, adult; *b*, pupa; *c*, larva, side view; *d*, head of larva, front view; *e*, first abdominal segment of larva; *f*, larva, dorsal view—all greatly enlarged. (After Chittenden, Bur. of Ent., U. S. Dept. of Agriculture.)

holds together the particles of food material. Pupation takes place in a silken cocoon-like web from which the moths emerge. From four to five weeks only are required for a generation to develop. In a heated building this insect will breed throughout the year.

The adult is a small moth having a wing-spread of about five-eighths of an inch; forewings whitish at base with distal half reddish-brown, as shown in figure 4.

The Mediterranean Flour Moth, *Ephestia kuehniella* Zell.

This insect is regarded by Chittenden as the most important of all the species infesting flour and grain mills. It has been reared from flour in New Haven and has been taken at Branford. In life history and injury the Mediterranean flour moth resembles the Indian meal moth, and in heated buildings five or six broods may occur each year. The moth is shown on plate XXVI, c. It is larger than the Indian meal moth and has a wing-spread of about an inch. The forewings are dull lead-gray, crossed by zigzag darker lines or bands. Not only does this insect injure flour and grain but also feeds upon almost any kind of stored vegetable food products.

The Meal Snout Moth, *Pyralis farinalis* Linn.

This insect infests flour, meal, and other stored food products, though not as serious a pest as the Indian meal moth or the Mediterranean flour moth.

The larvae have the habit of constructing long tubes by binding together with silk small particles of the meal or food material. In these tubes the larvae live and hide until fully grown when they leave the tubes and spin their cocoons, usually in or just outside of the infested material. There are probably three or four generations each year, though further studies are needed in this latitude to determine this point.

The adult has a wing-spread of about an inch, is light brown, with thorax, base and apex of fore wings darker brown, and with whitish wavy lines crossing front and rear wings, as shown on plate XXVI, a.

THE GRAIN MOTHS.

The Angoumois Grain Moth, *Sitotroga cerealella* Oliv.

This destructive insect was known in France nearly two hundred years ago, and was somehow brought to this country in the early colonial days, and became established in North Carolina and Virginia. Since then it has spread northward to Massachusetts, New York and Michigan and throughout the southern states, where it does much damage. The writer first noticed it in Connecticut nearly twenty years ago, and has run across it a

number of times since. It is primarily a pest of stored grains, especially corn on the ear, which if infested soon appears as shown on plate XXVII, b. The emerging moths leave small circular holes in the kernels. Infested grain is injured not only for seed, but also for feeding purposes; as it has been estimated that it loses within six months 40 per cent. of its weight and 75 per cent. of the starchy matter. The moth lays whitish eggs on the kernels of corn, and they soon turn to a pale reddish color and hatch in five or six days. Two or more larvae may occupy a single kernel of maize, though only one occurs in a grain of wheat. The adult is a light, grayish-brown moth, having a wing-expanse of about half an inch, somewhat resembling a clothes moth. Out of doors in the southern states there are at least four broods annually and the larva passes the winter in kernels of grain. In this climate it breeds only in stored grain, and in heated buildings this goes on continuously, there probably being five or six generations, depending upon the temperature.

The European Grain Moth, *Tinea granella* Linn.

Compared with the Angoumois grain moth this moth is of secondary importance, and seems to be not especially destructive in the United States. It infests all kinds of cereals, and as each larva may pass from one kernel into another, webbing them together until twenty or thirty grains are spoiled, it is apparent that considerable injury must result.

This moth was first found in Connecticut, in 1906,* in a seed warehouse in Milford. It is now distributed throughout the northern states.

The adult is a slender moth with a wing-spread of half an inch, creamy white mottled with brown. This moth and its work are shown on plate XXVI, b and e.

OTHER INSECTS OCCASIONALLY ATTACKING FOODS.

The large cabinet beetle, *Trogoderma tarsale* Melsh., frequently injures seeds and is shown on plate XXVI, d. The small cabinet etle, *Anthrenus verbasci* Linn., and the black carpet beetle,

* Report of this Station for 1906, page 305.

Attagenus piceus Oliv., occasionally attack and injure food products, though the latter is a more important pest of clothing.

The larder or bacon beetle, *Dermestes lardarius* Linn., the red-legged ham beetle, *Necrobia rufipes* Fabr., and certain species of mites of the genus *Tyroglyphus* sometimes injure dried meats, cheese, dried fruits, cereals, etc. The cigarette beetle, *Lasioderma serricorne* Fabr., though primarily a pest of tobacco, feeds upon the spices, rice, figs and many other food products. Then the cheese skipper, *Piophila casei* Linn., which occurs everywhere, often attacks cheese and the larvae may be found tunneling in it. Cheese should be kept covered and should be examined every day in warm weather. Hams and other kinds of meat are infested only in certain portions which can be cut off and the remainder used for food.

A species of book-lice, *Troctes divinatorius* Müll. (order Corrodentia), was found eating corn at the Station in 1900. The sample was stored in a ground glass-stoppered jar. The outer surface of the kernels was wholly eaten off, so as to render the variety wholly unrecognizable.

Cockroaches and ants are also frequently injurious in pantries and storehouses. The former are usually susceptible to the influence of powdered borax, and ants can usually be driven away by scattering naphthalene flakes about on the floor and shelves, especially where the ants have their runways.

The other insects mentioned in this chapter without control methods may be killed by heat or by fumigation.

CONTROL METHODS.

The chief methods for preventing damage by the insects mentioned in the foregoing pages are: the use of high and low temperature, air-slaked lime, pest-proof packages and fumigation.

TEMPERATURE.

Temperature is recognized as an important factor in insect development, and often determines in a measure the number of annual generations of certain species. Extremes in temperature are sometimes employed for the control of insects.

Heat.

It has long been known that heat will kill insects, and one of the simplest methods of destroying them in small packages of flour or other food products is to heat it in the oven for an hour or so. Following this idea Professor George A. Dean started some experiments in Kansas in 1910 to determine the fatal high temperatures for certain grain-infesting insects, and found that few insects can withstand a temperature of from 118°-125° F. for any length of time. In a mill there are accumulations of meal and floor on the floor, beams, machinery, and in the corners everywhere in which insects can breed. To keep a mill free from this accumulation and absolutely clean is almost an impossibility. By the use of heat, however, the insects can be killed from time to time without serious inconvenience, without shutting down the mill, and without great expense. It requires extra steam pipes sufficient to raise the temperature to about 120° F., and to keep it there for a period of five or six hours to allow the heat to penetrate the bins and bags of grain. Professor Dean has published three papers on this subject,* and any one interested should write to him for further advice.

Any grain or seeds which are intended for planting should not be heated to a point much greater than 130° F. as there is danger of injuring the vitality, which with some seeds ceases if the temperature approaches 150° F.

Any product to be used for food will not be injured by this heating method and even the eggs and larvae, as well as the adult insects, are killed by it.

Cold.

A low temperature is not so frequently used for destroying insects, yet it has been known for a long time that insect development is arrested or suspended altogether in cold storage.

Mr. J. A. Manter† of Storrs, Conn., states that the bean weevil will not breed in cold storage and suggests that beans be stored

* Journal of Economic Entomology, Vol. IV, page 142, 1911; Vol. VI, page 40, 1913. Kansas Agricultural Experiment Station, Bull. 189, July, 1913.

† Journal of Economic Entomology, Vol. X, page 193, 1917.

in unheated buildings. This idea may be carried out in practice with certain other stored food insects but the exact temperatures have not yet been determined for all species.

Air Slaked Lime.

A very simple and promising treatment to prevent weevil injury to peas, beans, cow peas and possibly to other kinds of seeds has recently been discovered by Mr. Z. P. Metcalf* of the North Carolina Station. This consists of applying air-slaked lime to the seeds, using one part by weight of lime to two parts of seeds when placing the crop in storage. For small quantities, say less than a half-peck, Professor Metcalf advises the writer in a letter that four parts of lime should be used to one part of seeds; for quantities between a half peck and three bushels, use equal amounts of lime and seeds. The quantity of seeds to be stored thus influences the effectiveness of the treatment and necessitates greater proportions of lime for small quantities. In time this method may be found applicable to other kinds of seeds and against other insects. It has the advantage of being harmless to seeds and to the operator, as well as being convenient to procure and relatively inexpensive. Professor Metcalf is now completing further tests of this material. Plate XXV, c, shows untreated seeds and those treated with lime.

Pest-proof Packages.

Materials sealed in glass or metal containers are usually safe against insects as long as they remain unopened. We have a number of records showing that the smaller beetles, like the saw-toothed grain beetle, will enter poorly stoppered glass bottles and jars and even tin-stoppered cans. The material is of course often infested before placing in the containers.

Mr. William B. Parker of the U. S. Bureau of Entomology has made investigations and suggests† a sealed paper carton for packing cereals which are to be placed upon the market. While this may prevent infestation in stores and warehouses, in the

* Journal of Economic Entomology, Vol. X, page 74, 1917.

† Bulletin 15, U. S. Department of Agriculture, 1913.

household many opened packages often attract insects, and if stored for a long time no paper package is insect-proof. Hence other methods must be resorted to, especially in dwelling houses, to keep the foodstuffs free from insect attack.

Fumigation.

Fumigation has long been practiced to kill insects in seeds and food substances. For this purpose two materials are commonly used, viz., carbon disulphide and hydrocyanic acid gas.

Carbon Disulphide (Bisulphide).

This is a colorless, ill-odored liquid which volatilizes at air temperatures, more readily in warm weather, and the fumes are deadly to all forms of insect life. Carbon disulphide may be purchased in pound bottles from any wholesale druggist, and as it is inflammable when the fumes are mixed with air, it should not be used by any one smoking, or at night with oil or gas lights near. As the fumes are heavier than air the liquid should be placed on top, rather than at the bottom of the grain, seeds or material to be treated. It should also be placed in a shallow dish to facilitate volatilization. The quantities used are about one pound to each 40 bushels of seeds, or to each 100 cubic feet of space. In a tight barrel containing grain or seeds, about one-half cupful of the liquid should be placed in a saucer on top of the seeds, the barrel covered tightly and allowed to remain all day or longer. For smaller receptacles, use proportionate quantities of the liquid. Carbon disulphide is more convenient, less dangerous to the operator, and its fumes penetrate better than hydrocyanic acid gas. A recent bulletin by Dr. Hinds* contains much information about carbon disulphide and may be obtained by applying to the U. S. Department of Agriculture, Washington, D. C.

Hydrocyanic Acid Gas.

This is a deadly poisonous gas generated by putting together cyanide, sulphuric acid and water. Potassium cyanide was

* Farmers Bulletin 799, U. S. Department of Agriculture, June, 1917.

formerly recommended, but sodium cyanide is now the cyanide of commerce and is effective. The quantities for 100 cubic feet of space are as follows:

Sodium cyanide	1 oz.
Commercial sulphuric acid	2 fluid ozs.
Water	4 fluid ozs.

If a room is to be fumigated its cubic space must be ascertained and the chemicals carefully weighed or measured. It must be made reasonably tight, and provision must be made for opening from the outside at least one window or door, besides the exit. The generating jar may be earthen or stoneware but never metal. The acid may be diluted with the water, the cyanide placed in a paper or cheescloth bag, and when all is ready the operator should drop the bag into the jar and with bated breath retire at once and close and lock the door. One full inhalation of this gas will drop a man, and no carelessness should be permitted. The house or room should be exposed for at least two hours and may remain closed over night or over Sunday. The fumes do not penetrate as well as those of carbon disulphide.

Recently Mr. E. R. Sasscer of the U. S. Department of Agriculture has devised an apparatus for fumigating cotton bales, bags of seeds, etc. By removing the air and forcing the gas into a partial vacuum thus created, most insects are killed with a half hour exposure.* On account of the danger, trouble of generating, etc., the average farmer and householder will seldom use hydrocyanic acid gas and will find carbon disulphide or heat sufficient to meet his needs.

SUMMARY.

Much damage results each year in Connecticut to cereals and other stored food products from the attacks of insects. This injury has been estimated at five per cent of the total value of the products, or $200,000,000.00 each year for the United States, and is wholly preventable.

The insects are chiefly beetles (*Coleoptera*) and moths (*Lepidoptera*). The former include the meal worms, cadelle, pea and bean weevils, drug store beetle, confused flour beetle, rust-red flour

* Bulletin 186, U. S. Department of Agriculture, 1915.

beetle, saw-toothed grain beetle, granary weevil, rice weevil, large and small cabinet beetles, black carpet beetle, larder beetle, red-legged ham beetle, and cigarette beetle. The latter include the Indian meal moth, Mediterranean flour moth, meal snout moth, Angoumois grain moth, and European grain moth. Other insects like the cheese skipper (a fly), a book louse, ants, cockroaches, and even mites occasionally cause damage.

The most important of these pests are described briefly in the preceding pages.

Most of these insects may be destroyed by raising the temperature to a point between 120° and 130° F. for five or six hours. The vitality of seeds is endangered if the heat approaches 150° F. but the material would not be injured for food.

Food kept in cold storage will not be injured by insects.

Various pest-proof packages have been devised, but food often becomes infested in them, and no package is pest-proof after the seal has been broken.

Air-slaked lime applied to seeds when placed in storage will prevent most of the damage caused by the pea and bean weevils. The proportions are as follows: For small quantities, say less than a half peck, four parts of lime to one part of seeds; between a half peck and three bushels, equal parts of lime and seeds; for greater quantities, one part of lime to two parts of seed.

Fumigating with carbon disulphide, using a half cupful to a barrel, will rid the material of insect life. This liquid should be placed on top of the infested material, and should not be used near a fire as it is inflammable. The container should be tightly covered for twenty-four hours or longer.

Hydrocyanic acid gas may also be used but is not advised except in particular cases, as it is deadly to breathe and does not penetrate masses of flour and grain readily. Seeds and food materials if thoroughly aired are not injured by carbon disulphide or hydrocyanic acid gas, either for food or for planting.

For more detailed information on this subject the reader should refer to pages 330 to 343 of this Report.

MOSQUITO WORK IN CONNECTICUT DURING 1917.

By B. H. WALDEN.

Legislation. The State law providing for the elimination of mosquito breeding places, Chapter 264, Public Acts of 1915 (See 15th Report Conn. State Entomologist, page 141, 1915), was amended by the 1917 Legislature to read as follows:

Chapter 402.

AN ACT AMENDING AN ACT PROVIDING FOR THE ELIMINATION OF MOSQUITO BREEDING PLACES AND AREAS.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

SECTION 1. The director of the Connecticut Agricultural experiment station may make rules and orders concerning the elimination of mosquitoes and mosquito breeding places, and he or his agent may enter upon any swamp, marsh or land to ascertain if mosquitoes breed thereon, or to survey, drain, fill or otherwise treat or make any excavation or structure necessary to eliminate mosquito breeding on such land.

Sec. 2. Whenever funds have been provided by the town, city or borough, in which any such swamp, marsh or land is located, or by voluntary contribution, sufficient to pay three-fourths of the cost, as estimated by said director, of work of eliminating mosquitoes or mosquito breeding on such swamp, marsh or land, and moneys appropriated by the state are available sufficient to pay one-fourth of said cost, or whenever funds have been provided from other sources than the state sufficient to pay all of said cost, said director may order the execution of said work upon notice as herein provided. At least thirty days before commencing such work, said director shall file a copy of such order, with a description of the place or area affected and a statement of the proposed plan thereof, in the town clerk's office in each town in which such place or area is located. Said director shall publish a copy of such order once each week for two successive weeks in some newspaper having a circulation in the town or towns in which such place or area is situated, and shall mail a copy of such notice, postage prepaid, by registered mail, addressed to each record owner of land whose name and address may be ascertained by a reasonable inquiry from the assessors of the town in which such land is situated. Said director may, and upon application of any person affected by such order or plan, within thirty days after such publication, shall assess benefits received and damages sustained by the owner of any such land. Such assessment shall be filed by said

director with the clerk of the superior court of the county within which the land affected is located, and said clerk shall give notice of such assessment to each such property owner, by mailing to him a copy of such assessment, postage prepaid. Any person claiming to be aggrieved because of such order or proposed plan or such assessment may, within ten days after notice, apply to the superior court in the county in which such land is situated, or any judge thereof, for relief, and said court or such judge may, after notice to said director and parties applying for relief, and hearing thereon, make any proper order concerning such order or proposed plan, or make a reassessment of benefits and damages. Said court or judge may view the land claimed to be affected by such order or plan and may take any evidence in its opinion material. The order, plan and assessment as hereinbefore provided for shall be conclusive upon all parties affected thereby, and the state treasurer shall pay to any such owner the damages assessed by said director or by said court or judge, as the case may be, upon certification of the amount by the clerk of said court. Benefits assessed as herein provided shall be collected by said treasurer and shall constitute a lien upon the land against which the same were assessed until the amount thereof has been paid with interest at the rate of six per centum per annum, which lien may be continued by filing in the office of the town clerk of the town where such land is situated a certificate thereof within sixty days after the assessment of the same, and such lien may be foreclosed or the benefits secured thereby collected in any other proper form of action. The town wherein such land is located shall reimburse the state for three-fourths of the damages assessed and paid as herein provided, and the state treasurer shall pay to any such town one-fourth of all benefits received. All amounts collected from towns under the provisions of this section may be expended for the purposes stated in said section. The pendency of any application for the assessment of benefits and damages shall not prevent or delay the execution of the work for the elimination of mosquitoes or mosquito breeding. Upon the completion, to the satisfaction of said director, of any such work one-fourth of the cost of which is payable by the state as hereinbefore provided, said director shall certify to the comptroller, with proper vouchers, the amount of such costs, and the comptroller shall draw his order on the treasurer for such sum as, with any amounts advanced on account thereof as hereinafter provided, shall amount to one-fourth of the cost of such work.

Sec. 3. Whenever any swamp, marsh or other land has been drained to the approval of said director, he shall keep the same in repair and free from obstruction, and construct or repair tide gates or otherwise treat such areas so as to make such work effective. The cost of such maintenance or treatment, not exceeding in any year one dollar per acre, shall be paid by the state, and the city, borough or town within which such place or area is located shall reimburse the state for three-fourths of the amount so expended for maintenance and treatment of such place or area. The provisions of this section shall apply to work executed prior to the passage of this act, provided such work shall be approved

by the director. Said director shall certify to the comptroller the amount due from any city, borough or town under the provisions of this section, and the treasurer of such city, borough or town, as the case may be, shall pay to said comptroller the amount so due upon receipt of a bill therefor. All amounts so collected shall be available for expenditures under the provisions of this section.

Sec. 4. Said director may appoint one or more deputies to supervise the work done under the provisions of this act, who may exercise the authority granted to such director, and the expenses of said director and said deputies for supervision and inspection shall be included in computing the cost of any such work.

Sec. 5. The sum of five thousand dollars is appropriated for the purpose of carrying out the provisions of sections one and two of this act, and five thousand dollars for carrying out the provisions of section three of this act. The comptroller may advance to said director such amounts, within such appropriations as are necessary to meet the current expenses for the labor authorized under the provisions of this act.

Sec. 6. This act shall take effect from its passage.

Approved May 16, 1917.

As section 4 of Chapter 264, Public Acts of 1915, was not repealed it still remains in force and is as follows:

Any person obstructing the work of examining, surveying, or ditching, or otherwise treating such mosquito breeding areas, or obstructing any ditch, canal, or drain, or the natural outlet of any marsh forming mosquito breeding areas, shall be fined not more than one hundred dollars, or imprisoned not more than ninety days, or both.

The new law provides for a more adequate method of notifying property owners regarding the ditching of their marshes, and provides for assessing benefits and damages in case the owners wish to apply to the courts. At the same time the law specifies that the work shall not be delayed while adjustments are being made. The measure carries an appropriation of $5,000.00 to pay for one-fourth of the cost of new work done under this law.

The maintenance of the work is placed under the Director of the Experiment Station instead of under the towns, as provided in the 1915 law, an appropriation of $5,000.00 being made to pay for one-fourth of the maintenance, which is not to exceed one dollar per acre during one year. Work done before the passage of the Act may be maintained as above after such work has been approved by the Director.

On June 1 the writer was appointed by the Director, Deputy in charge of mosquito elimination work.

New Haven Work.

The City of New Haven appropriated $10,000 for mosquito elimination work during 1917, which was to be expended under Chapter 264 of the Public Acts. The Anti-Mosquito Committee, Inc., of the New Haven Civic Federation, which had raised the funds and had charge of practically all the mosquito work done around New Haven, recommended that this money be used to ditch the remaining undrained salt marsh areas in the town of New Haven. These marshes were as follows: The Fort Hale or Harbor Marsh north of Fort Hale Road, about 120 acres; all of the Quinnipiac Marsh in the town limits, containing about 300 acres; and the West River Marsh between Congress Avenue and Chapel Street, 130 acres, making a total of 550 acres. This recommendation met the approval of Dr. Jenkins and plans were made to go ahead with the work.

The notice or order regarding the proposed mosquito work was published in the *Journal-Courier* on May 25, and under the law it was necessary to wait thirty days before starting the ditching. Two of the leading mosquito drainage firms were asked to bid on the work, and the contract was awarded to the United States Drainage & Irrigation Company of New York, the firm that did the ditching work around New Haven in 1912. The contract was let on a footage basis at a price of 2 5–8 cents per linear foot for 10" x 24" ditches. The Harbor Marsh and the Quinnipiac Marsh, like many other marshes in the State, contained many old ditches which we considered advisable to use in the new system in order not to cut up the marshes unnecessarily. Furthermore, many of these ditches form boundary lines between property owners, and in our previous work serious objections have been made where these boundary ditches have been disregarded, or where new ditches have been cut a few feet from the old ones. As the majority of these old ditches have to be cleaned by day laborers, it was specified in both bids that the cost of cleaning old ditches be figured as the equivalent of a double 10" x 24" ditch.

Harbor Marsh. The Harbor Marsh was the first one to be ditched. Work was started on June 27 and completed on July 5. The equivalent of 44,443 feet of ditch was cut. For a number of years there has been considerable mosquito breeding on the lower end of this marsh near Fort Hale Road, where the only outlet was a ditch to the south, emptying into the moat surround-

ing the old fort, where the water was so high that there has been very little drainage through this ditch. Formerly this portion of the marsh was drained by a ditch, long filled up, with an outlet into the harbor about 1,400 feet to the north. This ditch was re-opened, and while it lowered the water so that there was very little breeding during the remainder of the season, it does not carry off the water as well as expected.

Quinnipiac Marsh. The Quinnipiac Marsh was ditched between July 5 and July 28, a total of 167,988 feet of ditches being dug. The New York, New Haven & Hartford Railroad is filling a section of this marsh south of the Air Line tracks next to the Quinnipiac River. When the filling is completed it will cut off the drainage into the Quinnipiac River of a considerable section of the marsh to the east, and the new ditching has been planned to carry the water eastward into the large creek. It will be necessary to watch this system for another season in order to determine if it is adequate to prevent mosquito breeding. Plate XXVIII shows the appearance of a section of this marsh both before and after ditching.

West River Marsh. The ditching on the West River Marsh was started on July 20, and completed on August 27. 38,355 feet of ditches were cut. The conditions on this marsh are controlled by the large tide gates at the Congress Avenue bridge. These gates have leaked badly for several years and considerable of the time the water in the river has been high, flooding sections of the marsh. During the summer the city repaired these gates, but it is the writer's opinion that a great deal of water leaks through under the sill and that this defect was not remedied. Whether these gates can be kept in satisfactory repair, or whether it would be cheaper in the long run to build new gates is a problem that should be decided by an engineer who is familiar with the construction and operations of tide gates. It is also my opinion that the river needs dredging near the Derby Avenue bridge, and possibly at other points, before the water can be lowered sufficiently above Derby Avenue. Under the present conditions we cannot expect to obtain the best results from the ditching. Much of the surface water of the marsh, however, will be concentrated in the ditches, and the larger pools and lagoons have been connected by ditches with the river, which will prevent the water from becoming stagnant.

Aside from the problems mentioned in connection with the different marshes, the work has been satisfactory and many serious breeding areas have been eliminated. Had it been possible to complete the work in the spring, this season's results would have been much more apparent. During the early part of July when the ditching work was only well started, conditions were extremely favorable for mosquito breeding. The perigee tide was followed by east winds and frequent rains, which kept the depressions in the marshes filled with water, producing one of the largest broods of salt marsh mosquitoes known at this season of the year. Fresh water breeding was equally plentiful.

East Haven Work.

The Cosey Beach Improvement Association raised sufficient money to drain the small but serious mosquito-breeding marsh back of the Silver Sands summer colony and just west of the Momauguin shore resort. The outlet ditch of this marsh crossed the highway to the south and extended to the west for several hundred feet through a number of back yards where the property owners had covered the ditch or partially filled it, as they saw fit. It then again crossed the road to the north and extended to the west into Caroline Creek. The town authorities gave permission to cut an outlet north of the highway and on the town's right of way. This new outlet was 30 x 20 inches and about 700 feet long, and extended through a point of hard land where a number of rocks had to be blasted. While the cost was greater than that of ditching the marsh, it probably cost no more than it would to build two new culverts and clean the old ditch, and the new ditch is much more direct and will be considerably cheaper to maintain.

Additional ditches were cut in the marsh partially ditched in 1912, on the east side of Caroline Creek and connecting with this new work. The above work has done away with practically all of the salt marsh mosquito breeding from Caroline Creek to Mansfield Grove. As all of the money raised by this Association was not expended, the remainder will probably be used in the spring on the marshes back of Mansfield Grove.

Orange Work.

The contract which was let in December 1916, for ditching the lower part of Old Field Creek Marsh in West Haven, was carried

out this spring, the work being completed before the end of May. The town authorities co-operated with the members of the West Haven Anti-Mosquito Committee, who raised the money for the above work, built a new tide gate at the outlet of Old Field Creek, and cleaned the channel of the creek north of Blohm Street through the town property where the sewage disposal plant is located. Dr. Charles D. Phelps, a member of the Committee, has given all this work his personal attention. Plate XXIX shows a portion of this marsh before and after ditching.

Hamden.

The town, as in 1916, appropriated $300.00 to be used in anti-mosquito work during 1917 by the Health Officer, Dr. George H. Joslin. Efforts will be made to have this appropriation increased for 1918 in order to drain a serious malarial breeding swamp between Schuetzen Park and the railroad, just north of the New Haven town line.

Branford, Guilford and Madison Work.

The mosquito drainage work in Branford, Guilford and Madison during 1916 was done under Chapter 264 of the Public Acts, which provided that the maintenance be done by the towns. Early in April the selectmen of these towns were notified of this fact and advised of the importance of starting this work at once. In Madison the ditches were all cleaned under the direction of the first selectman before the middle of May. The work was gone over in Guilford and the principal obstructions in the ditches removed, while in Branford no work was done by the town.

After the present law was passed placing the maintenance under the Director of the Agricultural Station, the work was started as soon as possible. Plans were made to divide the territory into about three districts and engage a man to take charge and be responsible for the results in each district, hiring laborers for doing such work as was not practicable for him to do.

Mr. Joseph S. Miller, a student of the Connecticut Agricultural College, who was specializing in entomology, was engaged to take charge of one district. The season was so far advanced that most of the men who are usually available for summer work had already secured employment or entered training camps, and we

were unable at short notice to obtain suitable men for the remaining districts. As no work had been done in Branford, Mr. Miller started cleaning the ditches in this town and later took charge of the maintenance work in the other two towns.

BRANFORD.

After considerable difficulty, owing to the labor situation, two laborers were engaged and work was started June 4 on the Hotchkiss Grove Marsh. During the winter the tide gates at the outlet became damaged so that the marsh was flooded with water and many of the ditches partially filled with mud. Nearly full-grown larvae of *Aedes cantator* and *A. sollicitans* were present in many pools and even in some of the obstructed ditches, especially in the upper section of the marsh. These breeding places readily drained away when the ditches were cleaned, but as there was not sufficient time to go over the whole area before the adults emerged, a number of the breeding places were oiled.

The ditches in the remainder of the marshes in the town required only a small amount of cleaning aside from the removal of sod placed in the ditches by the farmer to bridge them, and occasional stoppage casued by material which had been carried in by high tides.

GUILFORD.

After the work was well started in Branford, the marshes in Guilford were inspected and it was found that while the principal obstructions had been removed by the town, very little had been done to remove the mud which had accumulated in many of the old ditches. Work was commenced as soon as laborers could be hired, and those employed in Branford were later moved to Guilford.

The small tide gate at the Leete Marsh was found to be leaking badly around the box where the water had worked through. A member of the Connecticut Shore Mosquito Extermination Association, who had a summer residence in the vicinity, offered to pay the cost of having a concrete facing, on which to hang the gate, built on the outer side of the box. This improvement was made and the water in the ditches was lowered sufficiently to thoroughly drain the marsh.

The need of a new tide gate at the outlet of the Great Harbor Marsh has been apparent during the past two seasons. Authority for building tide gates is granted in the new law under Maintenance (Sec. 3) so that the cost of construction, together with the cost of maintenance, is limited to one dollar per acre. Plans were made for a new gate to be attached to the trestle of the Shore Line Trolley which crosses the Great Harbor Creek near its outlet. By the time estimates on the cost of building could be obtained and permission received from the trolley officials to attach the gate to their structure, it seemed advisable to wait until spring before installing the gate.

Before all the Guilford marshes could be covered, the July perigee tide occurred, which was abnormally high, due to strong east winds. This was followed by frequent rains and produced scattered breeding over the marshes. Many complaints were received regarding the abundance of mosquitoes in Guilford borough which did not seem to be explained by the amount of marsh breeding. Mr. Miller investigated the matter and reported that nearly every rain barrel and receptacle containing water that he examined were breeding mosquitoes. Many unused boats with water in them also contained wrigglers. One individual, living on one of the main streets, who was complaining to Mr. Miller about the abundance of mosquitoes, was shown prolific breeding in a boat in his back yard.

MADISON.

The box culverts that were placed in the outlets to several of the small marshes in 1916, all remained in place during the winter. While the ditches on the Madison marshes were cleaned in the spring by the town, there are a number of small marshes that are drained through old outlet ditches which require considerable cleaning throughout the season, thus adding materially to the cost of maintenance.

Cost of the Maintenance Work.

Labor	$1,193.57
Tools and supplies	29.24
Supervision and Inspection	424.29
	$1,647.10
Cost per acre	.617

The results of the maintenance work in these shore towns was as satisfactory as could be expected under the circumstances. The greater part of the work which should have been done early in the spring, had to be done after the first of June when the breeding season was well under way.

It was not practicable to organize the work and engage men beforehand in anticipation of the passage of the law. Labor was scarce and the majority of the few men looking for work preferred other kinds to that on the salt marsh, even though the pay was less. It was necessary to pay nearly twice as much for laborers as it would have been two years ago.

Fairfield Work.

The salt marshes in the town of Fairfield, about 1,250 acres, were ditched to eliminate mosquito breeding in 1912, the necessary funds being raised by private subscription. The work has since been maintained under the supervision of the Improvement Association of Fairfield. During the last week in June a request was received from the first selectman of the town that the maintenance of this work be taken over by the Director of this Station, under the new law. The work was inspected by the writer and approved on July 11. The maintenance work was being done by Mr. Nicolas Matinck, who had also been employed during 1916. Mr. Matinck continued with the work until September 1.

Proposed Work in Westport.

Early in the spring the State Comptroller requested that the marshes in the town of Westport on or adjoining the State Aviation Park at Alvord's Beach, be examined to determined the mosquito breeding conditions. Westport is the only town between Fairfield and the New York State line where the salt marshes have not been drained to eliminate mosquito breeding. As it will be necessary to ditch all of these marshes in order to obtain any definite results, all of the salt marshes in the town were examined on April 16. The report sent to the Comptroller was as follows:

WESTPORT SALT MARSHES.

Examined April 16, 1917, by B. H. Walden.

There are about 330 acres of salt marsh in the town of Westport. The problem of ditching to eliminate mosquito breeding is a simple one. The areas are comparatively small and well supplied with natural water courses or creeks. These marshes, like most of those in the state, were formerly ditched for salt hay farming, and while salt hay is still cut on considerable of the area, the ditches have been neglected and most of them nearly filled up. While the whole area needs ditching, with a few exceptions, it probably will not be necessary to cut ditches nearer than 150-175 feet apart.

Detailed accounts of the separate areas follow: 1 & 2. Marsh southwest corner of town west of the Saugatuck River. Area about 74 acres. Adjoining marsh in Norwalk ditched in 1912. This area requires the longest ditches of any marsh in the town (about 1,000 feet). It may therefore be necessary to place them not over 125-150 feet apart.

Salt hay was cut on a large portion of this marsh in 1916 and the western part of it was fairly hard and dry on April 16.

3. About 5½ acres. Appears to be well drained. Hay cut in 1916. May require a few short ditches.

4. Marsh west of station south of railroad tracks. Thirteen acres. Good natural drainage. Probably needs marginal ditches. West of the highway is a small marsh of iess than one acre, the outlet leading through a culvert under the road into a creek of No. 4. This marsh is in a very bad condition and needs thorough ditching. Probably considerable fresh water comes onto this marsh and the indications are that it is a malarial mosquito breeder.

5. This is the upper end of the marsh No. 4 above the railroad tracks. The main ditch needs cleaning the whole length. Sink drains on the western bank run into this marsh producing an unsanitary condition; tile drains should be laid to the main ditch.

6. Small narrow marsh west of main road east of Cedar Point. About ½ acre of the lower end of this marsh needs ditching.

7. West side of Mill Cove. Area 20 acres. Upper portion needs ditching. Hay cut on most of this marsh.

8. Triangular marsh south of railroad extending into Mill Cove. Needs two or three cross ditches. Area 11 acres.

9. Marsh on east side of Mill Cove. Area about 46 acres. East side of creek hay has been cut. Needs ditching, especially west of creek.

10. Marsh adjoining State Aviation Park—about 128 acres. On the west side of marsh part of the hay has been cut. Needs ditching. In the central portion of marsh about 20 acres probably well drained by natural creeks. Southwest corner either on or adjoining State property especially needs ditching.

The west half of the marsh south of the creek and owned by the State probably requires no ditching. The east half of the marsh owned by the State should be drained with ditches about 175 feet apart.

The outlet of the creek that drains this marsh (the northern boundary of the State property) is through the beach where it is in danger of filling up. While the outlet is adequate for good drainage, at the present it will require opening occasionally. The northern part of the marsh needs ditching.

11. Marsh south of Greens Farms railroad station. About 17 acres. This marsh is in fair shape but will require ditching.

12. Marsh near east boundary of Westport southwest of the mouth of Sasco Creek. Area 10 acres. Old ditches need cleaning and an occasional new ditch.

13. Marsh west side Sasco Creek. Area 20 acres. The area between the railroad and the highway on the south has been ditched. The area north of the railroad probably has been ditched but was not examined.

During the past season Mr. W. L. Searles of Rowayton, who was mainly responsible for carrying out the ditching in the towns of Norwalk and Darien, spent considerable time in interesting the people of Westport to raise funds for ditching these marshes. On August 21, the writer met Mr. Searles and visited some of the people interested in the work. More than one-half of the necessary funds were pledged and it is hoped that sufficient money will be available to carry out the work in the spring.

ENTOMOLOGICAL FEATURES OF 1917.

The winter was rather mild and the temperature did not go sufficiently low to kill the peach buds—or at least a large proportion were not killed. Spring came late, however, and the blossoming of fruit trees and other events in plant development were fully two weeks—and in some instances three weeks—behind the average season. Spring and early summer, therefore, were cold and wet. Seeds requiring a high temperature could not safely be planted until late in May or even in June. Rainfall was heavy until August 1st, and the remainder of the season it was light—somewhat below the normal. On account of stormy weather while fruit trees were in bloom, bees could not work the blossoms, consequently there was a poor set of apples in many orchards on account of lack of pollination. The young apples fell off from each fruit cluster by the handful, because the flowers had not been fertilized. There was much damage from rosy aphis, *Aphis sorbi* Kalt, and from the false red bug, *Lygidea mendax* Reut.

Though there were many egg-clusters of the tent-caterpillar, *Malacosoma americana* Fabr., there were few nests, and comparatively few caterpillars developed and produced adults. Consequently the egg-clusters will not be found abundantly on the trees this winter.

Canker worms did only a moderate amount of damage.

The first rose chafer observed was on June 18, and a few days later the beetles came in their usual numbers. The earliest date heretofore recorded for New Haven is June 9, and the beetles usually appear in abundance on June 12.

In truck gardens the cabbage root maggot caused the usual amount of damage.

Cut worms were not especially troublesome. The striped cucumber beetle, *Diabrotica vittata* Fabr., was very abundant and troublesome at the Station farm at Mt. Carmel, and squash bugs caused the usual amount of injury.

Wireworms were reported as seriously injuring tobacco in a number of fields, and later in the summer attacked potato tubers in the ground.

The wheat midge, *Contarinia tritici* Kirby, injured a field of rye in Yalesville, and caused slight damage to a field of winter wheat in Westport.

Perhaps the most prominent entomological feature of the season was the outbreak of the pink and green aphid, *Macrosiphum solanifolii* Ashmead, in potato fields all over the State. This pest appeared in July, and in most cases the plants were seriously infested before the insect was known to be present. Spraying with nicotine solution was practiced but the injury had already been done and the yield was greatly reduced, thus causing a loss of thousands of dollars for the whole state. There were fields here and there which were not attacked, but the pest was reported from every county in Connecticut, and the infestation was rather general. It was especially prevalent in New Haven County.

The elm leaf beetle was observed at several points, and seemed to be more prevalent, particularly along the shore, than for several years.

Tussock moths were unusually abundant. The white-marked tussock moth, *Hemerocampa leucostigma* S. & A., was perhaps even more abundant than in 1916. The white egg-clusters were in evidence on the trunks and branches of trees in the cities and

towns and the caterpillars injured the foliage. The hickory tussock moth, *Halisidota caryae* Harr., was more prevalent than since 1907. The tessellated tussock moth, *H. tessellaris* S. & A., was more abundant than I have ever seen it around New Haven, and late in the summer the caterpillars were crawling everywhere in company with those of the other two species just mentioned.

The fall webworm, *Hyphantria cunea* Dru., was also prevalent and its nests were seen on fruit, shade and woodland trees throughout the State.

In young orchards and nurseries, the red-humped caterpillar, *Schizura concinna* S. & A., and the yellow-necked caterpillar, *Datana ministra* Dru., were unusually abundant and could be seen feeding in clusters, often stripping the trees. The walnut caterpillar, *Datana integerrima* G. & R., was more prevalent than for several years and completely defoliated many black walnut, butternut and hickory trees in August.

Adults of the eight-spotted forester, *Alypia octomaculata* Fabr., were common in June, but there was no such stripping by the caterpillars observed or reported as took place in New Haven in 1916.

Grasshoppers and crickets were very abundant during August and September and devoured much of the second crop of hay in many fields.

The turnip aphid, *Aphis pseudobrassicae* Davis, appeared in a few turnip fields but caused no such destruction to turnips and kale as was the case in 1916.

The imported cabbage worm, *Pontia rapae* Linn., and the cabbage looper, *Autographa brassicae* Riley, were prevalent in all cabbage fields in late summer and riddled the leaves.

The apple maggot, *Rhagoletis pomonella* Walsh, continues to do its usual amount of damage.

The Bureau of Entomology of the U. S. Department of Agriculture at Washington has, during the year, established in Connecticut at Wallingford a field station for the study of deciduous fruit insects, to be conducted in co-operation with this Station. Mr. E. H. Siegler is in charge of this field station and it is planned to start work of an investigative nature on the tent-caterpillar, apple maggot, peach borer, and possibly certain other fruit insects which need to be studied under Connecticut conditions. It is hoped that the orchardists of the State may receive much benefit from these investigations.

The brown-tail moth has through the year been very scarce throughout the area supposed to be infested, and has not extended its range the usual distance westward. The towns were not required to spend any money in destroying nests as in 1916.

There was a marked increase in the number of infestations of the gipsy moth, apparently due to wind-spread in the spring of 1916, though this was not discovered until scouting was done the following winter. This increase was especially noticeable in the towns of Thompson, Putnam, Woodstock and Killingly, but also showed in Pomfret, Eastford, Brooklyn, Hampton and Canterbury.

A new peach pest, *Laspeyresia molesta* Busck, has appeared in Stamford and New Canaan. This insect is a small moth and the larva is a borer in the terminal twigs of peach trees in orchards. So far this insect has not been found in the nurseries of Connecticut.

The army worm, *Cirphis* (*Heliophila*) *unipuncta* Haw., was reported from Northford and Orange, but only a few caterpillars were seen and did no damage.

A leaf-roller, *Olethreutes hemidesma* Zell., was common on *Spiraea Van Houtei* in some parts of the State.

As regards anti-mosquito work, considerable progress was made during the year. The legislature amended the law, greatly improving it and providing for both new work and maintenance to be done by the State, and making a small appropriation for the purpose. Three-fourths of the cost of the maintenance is collected from the towns by the State Comptroller. The first part of the season was rainy, forming pools, and was favorable for breeding mosquitoes. Considerable new ditching work was done in New Haven, East Haven and Orange, and maintenance work in Branford, Guilford, Madison, New Haven and Fairfield was supervised by the State.

More detailed accounts of the principal features of this chapter will be found in the pages of this report.

MISCELLANEOUS INSECT NOTES.

A Sawfly Borer in Poplar. On September 25, 1916, Mr. Zappe collected some borers in small twigs of Lombardy poplar near Derby. On June 1, 1917, an adult emerged, which we recognized as *Janus abbreviatus* Say, a species not before recorded from Connecticut.

Sawfly Larvae on Austrian Pine. On August 2, 1916, Mr. Zappe collected some sawfly larvae on Austrian pine in a nursery in New Haven. The larvae live in silken tubes or webs, and spend the winter in cells in the ground. On June 7, 1917, adults emerged which have been identified by Mr. Rohwer as an undescribed species of *Itycorsia*.

Army Worm. The army worm, *Cirphis* (*Heliophila*) *unipuncta* Haw., which was prevalent in the State in 1914 (See Report of this Station for 1914, page 157), was reported from two places in 1917. Caterpillars were brought in from Northford and were observed in Orange. They were not abundant, only a few being noticed, and did no appreciable damage.

Long-Horned Beetle a Borer in White Pine. On September 22, 1916, Mr. Zappe collected some borers in white pine on the grounds of Mr. C. H. Sierman in Hartford. These borers were in the main stem in about the same place that one would expect to find the white pine weevil, though perhaps a trifle lower, and some of them tunneled into the center of the stem. These were placed in a breeding cage, and on June 10, 12 and 26 adults emerged. They proved to be *Monohammus titillator* Fabr.

Leaf Roller on Virginia Creeper. In 1916 the writer noticed several rolled leaves on a Virginia creeper on his front porch, and on August 27 collected a few specimens for the insectary. On June 18, 1917, there emerged a small black moth marked with white spots and known to entomologists as *Desmia funeralis* Hübn., of the family Pyralidae. This insect also feeds upon grape.

A Sawfly on Balsam Fir. On July 24, 1917, we received some sawfly cocoons, collected in Danielson by Mr. Davis on Balsam fir. The pupae were rather abundant, and much resembled those of *Diprion simile*. On August 6, adults began to emerge. Mr. S. A. Rohwer has identified the species as *Diprion abietis* Harr., which has been previously recorded from Connecticut.

Twig Borers in Sourwood, Dogwood and Azalea. While inspecting nurseries in August and September, 1916, Mr. Zappe found several twigs containing borers. At one nursery in New Haven a branch of the sorrel tree or sourwood, *Oxydendrum arboreum* was infested; at another he found an azalea stem tunneled; at a Hartford nursery a red-twig dogwood was attacked. As these twigs all contained the larvae, they were placed in separate cages in the insectary. During the last of May the adults emerged.

That from the dogwood was *Oberea tripunctata* Swed. Those from Azalea and *Oxydendrum* proved to be *O. tripunctata* var. *myops* Hald.

The Sinuate Pear Borer in Connecticut. On May 29, 1917, a piece of bark from a pear tree was received from Mr. G. S. Brown of Norwalk. Mr. Brown wrote that a worm had eaten under the bark all around the trees and the branches. Several trees were attacked. The work of the insect was probably that of the sinuate pear borer, *Agrilus sinuatus* Oliv., which has damaged pear trees in New Jersey for at least twenty years, but which has not before been reported from Connecticut. No good remedy has been found other than destroying the infested trees.

Harrisina americana on Virginia Creeper. On August 27, 1916, the writer gathered from a Virginia creeper vine a colony of small larvae feeding upon a leaf. The dorsal surface was striped crosswise with black and yellow bands, and there was a black line on the side of the body. Under surface was white. Adults emerging June 12, 1917, were *Harrisina americana* Harr., a small moth with narrow, smoky wings, belonging to the family Pyromorphidae. The food plants are grape and Virginia creeper.

A Pest of Wheat Middlings. On October 10, 1917, specimens were received from Mr. A. D. Jacot, R. F. D. Sandy Hook, of wheat middlings infested with some form of insect life. The sample was examined and the insects were found to be winged psocids (family Psocidae) and were identified by Mr. Nathan Banks as *Pterodela pedicularis* Linn., a species with a previous record of doing damage in various stored plant and animal products. Heat would be a satisfactory remedy.

Weevil in Evening Primrose. The evening primrose (*Œnothera biennis*), commonly regarded as a weed in waste fields, is a common inhabitant of orchards, growing around the borders, or in that portion between the cultivated strips, if clean cultivation is not practiced. In nurseries the plant is common and in one nursery at New Canaan nearly every plant was infested with grubs tunneling in the stem, the tunnels being shown on plate XXXI, b. Adults were reared October 23, and were identified as *Tyloderma foveolatum* Say, one of the weevils or snout beetles.

A Leaf Beetle on Peas. On July 20, 1917, larvae were brought to the Station which had been found feeding upon peas and wild morning glory at Triangle Farm, Wallingford. These somewhat

resembled the larvae of the squash lady-beetle, but were without spines. On July 30, adults were reared, and proved to be *Chelymorpha argus* Licht., a leaf beetle of the family Chrysomelidae. This beetle commonly feeds upon the wild morning glory (*Convolvulus*), and sometimes attacks milkweed (Asclepias) and raspberry, but I do not recall having seen it recorded as attacking peas.

The Cynthia Moth at Stonington. On September 10, 1917, a caterpillar of the Cynthia moth, *Philosamia cynthia* Drury, was received from Mr. Oscar Swallow of Stonington. This caterpillar pupated September 15. Mr. Swallow gave Mr. Zappe some cocoons collected November 11, 1917. The caterpillars feed upon the leaves of Ailanthus or Tree of Heaven. They are large, fleshy, green caterpillars bearing soft bluish protuberances. The adult has a wing-spread of four or five inches, ground color olive drab, with wings crossed by pink and white bands, and each wing bearing a transparent eye spot edged with yellow. The species is an importation from China, and has become fairly common in the vicinity of New York City. It has previously been reported from Greenwich, Conn.

Elm Leaf Beetle More Abundant. For several years the elm leaf beetle has been on the decrease in Connecticut so that in most towns along the coast spraying the elm trees has not been practiced and little injury has been done to the trees. In 1917, however, increased activities of this insect were noticed at several points. There were many riddled leaves in Fairfield and vicinity, and at Greenfield Hill many trees were entirely defoliated. Its ravages, though less marked, were noticed at Manchester and Saybrook. These observations indicate that the elm leaf beetle may again appear in devastating numbers, and the residents of each town should be on the watch, ready to spray before the trees are injured. One thorough application of lead arsenate (3 lbs. of the paste in 50 gal. of water) about June 1st will generally protect the foliage for the season.

Eggs of the European Lackey Moth or Tent-Caterpillar Intercepted on Nursery Stock from Holland. On November 16, 1916, while inspecting some imported nursery stock at the greenhouses of the M. A. Free Co., Stamford, Mr. Zappe found an egg-cluster of the European lackey moth or tent-caterpillar, *Malacosoma neustria* Linn., which had been brought over in the shipment from Boskoop, Holland. There were several kinds of plants in the

shipment, including a species of *Malus*, upon which the caterpillars are known to feed. This insect makes nests on the trees and the caterpillars feed upon the leaves of fruit and other deciduous trees in much the same manner as the tent-caterpillar and the forest tent-caterpillar in this country. Had this egg-mass not been intercepted, a colony might have started, from which this additional pest might have become established in this country.

Disappearance of Tent-Caterpillar. The tent-caterpillar, *Malacosoma americana* Fabr., which has been exceedingly abundant during the past four years, has almost entirely disappeared in Connecticut. Egg-clusters were fairly common and it was expected that nests would be seen here and there on apple and wild cherry as usual, though perhaps in fewer numbers. In many cases the eggs hatched and the young caterpillars began their nests. The nest building did not develop far, however, and very few caterpillars ever developed into pupae or adults. Consequently this insect will not be a pest to reckon with in 1918. The writer was informed of one locality in Windham County where the caterpillars hatched and the nests developed normally. Here many mature caterpillars were seen and possibly egg-clusters may now be there upon the twigs of the trees. But in most sections of the State this insect was scarce in 1917 and will probably be even more so in 1918. The reason for its disappearance cannot be explained here, but is probably the effect of parasites or other natural enemies. The tent-caterpillar fluctuates in abundance, and periodically about every ten or twelve years is extremely abundant. This period of abundance usually lasts two or three seasons but in the period just passed, it has been abundant for four, and in some sections for five years.

A Bark Miner of Apple Twigs. Several times during the past fifteen years correspondents have sent to the Station specimens of apple twigs with serpentine mines just under the epidermal layer and light brown in color, being rather conspicuous on the twigs. The writer has often observed and collected material of these mines and once obtained a flattened larva, which was mounted in balsam. All efforts to rear the adult failed though many trials were made. Recently, however, the life history of this insect has been worked out by Mr. Stuart C. Vinal, who has published

the result of his studies.* It proves to be the larva of a small moth, *Marmara* (*Gracilaria*) *elotella* Busck, originally described in 1909.† Several times each year twigs are received which contain these mines. Thus, on November 24, 1916, some were sent from Norwalk; January 2, 1917, Cos Cob; February 13, Norwichtown; February 20, Cheshire; March 5, South Norwalk; March 30, Norwich. The larva and the mined twigs are shown on plate XXX, b and c. Apparently little or no injury results from these mines as the cambium is not reached. Hence control measures are scarcely needed.

A Leaf-Roller on Spiraea: Olethreutes hemidesma Zell. When inspecting nursery stock in the town of Ellington, August 14, it was noticed that many of the terminal shoots of *Spiraea van houtei* had their leaves drawn and fastened together by silk threads. Inside some of these nests a larva was found; others were empty. These nests were more plentiful in Ellington than in any other nurseries in the State, though noticed in Manchester. They are shown on plate XXXI, a.

A number of the nests were gathered, brought to the Station and placed in cages in the insectary. On August 24 several adults had emerged, and were recognized as *Olethreutes hemidesma* Zell., a moth of the family Tortricidae. This moth has a wing-expanse of about five-eighths of an inch, is chocolate brown in color, with the basal portion of the wings more or less mottled and marked with narrow, white, sinuous transverse lines. It is shown on plate XXXI, b.

This insect will probably not become sufficiently abundant to seriously injure or disfigure the shrubs, but in case it does, spraying with lead arsenate may be practiced. The poison should be applied during July. Clipping off and burning the infested shoots will also help to control the insect and may be the only control measure necessary if one has only a few shrubs in danger of attack.

Abundance of Grasshoppers. During the summer of 1917 grasshoppers and crickets were unusually abundant, and did considerable damage by eating the second crop of grass in many fields. At the Station farm at Mt. Carmel, in the orchards where spraying experiments were conducted, around the nurseries which we inspected, and in other places visited in various parts

* Jour. Econ. Ent. Vol. 10, page 488, 1917.

† Proc. Ent. Soc. Wash. Vol. xi. page 102, 1909.

of the State, the conditions were similar. Both immature and mature grasshoppers were present and in many cases the results of their feeding were noticeable. There is some danger that they may do damage in these fields next year. Probably the best method of control is the poisoned bran mash, such as is recommended for cutworms. It may be prepared as follows:

Wheat Bran	25 lbs.
White Arsenic or Paris Green	1 lb.
Cheap Molasses	2 qts.
Lemons	3
Water	3½ gallons.

Mix the bran and poison together thoroughly while dry. Squeeze the juice of the lemons into the water and also add the pulp and rind cut in small pieces. Add the molasses and stir. Add this liquid slowly to the poisoned bran and mix thoroughly. When finished, this mash is rather dry and easy to spread. To kill grasshoppers it should be sown or scattered about over the infested fields.

An Injurious Weevil Attacking Red Pine. On August 11, 1917, Mr. A. E. Moss, Assistant Forester, sent to the Station from Norfolk a section of the main trunk of a red or Norway pine about four inches in diameter which had been weeviled, even below the surface of the ground, and killed. The cells contained larvae and pupae which seemed somewhat larger than those of the white pine weevil, which kills the leaders of white pine trees throughout the Northeastern States. Moreover, the trunk or stem in this case was much larger and had thicker bark than the favorite point of attack of the white pine weevil. The red pine trunk was photographed and placed in breeding cages. On August 20, several adults had emerged, and Mr. Walden identified the species as *Pissodes approximatus* Hopkins, described in Technical Series No. 20, page 49, Bureau of Entomology, U. S. Department of Agriculture. The adult resembles the white pine weevil, but is a trifle larger, with markings more prominent, and wing covers more strongly narrowed posteriorly. It is shown on plate XXXI, c, and its work on plate XXXII.

Such attacks would finally kill the trees. Apparently only an occasional tree is attacked. In the red pine plantations of the

State Experimental Forest at Rainbow no such attack has ever been observed. A few years ago similar injury to a young stone pine was noticed in one of the nurseries, and the tree sent to the Station. All weevils had emerged, however, and nothing enlightening could be learned about it. At present, destroying the infested trees seems to be about the only control measure to be recommended.

Wheat Midge Injuring Rye in Connecticut. In response to a complaint, Mr. Zappe visited the field of Mr. George E. Hough at Yalesville, Town of Wallingford, on June 25, 1917. About half of a rye field containing about four acres produced no kernels in the heads, though plants and heads were otherwise well formed and thrifty. The other half sown two weeks later gave a good yield. This difference was sharply marked and could be detected from a distance, the injured field ripening and the straw turning yellow earlier than the uninfested field. A careful examination of the empty heads revealed the cause of the failure. Small reddish maggots were present in the hull where each kernel should be. These are the larvae of a small, two-winged fly known as the wheat midge, *Contarinia tritici* Kirby, a species first observed in England in 1795, and first noticed in America near Quebec in 1819, and in northern Vermont in 1820. About 1828 this insect had increased to such an extent that the wheat crop was abandoned in many localities in northern New England. Every few years until about 1860, this insect caused severe injury, the most serious being in 1854, when Dr. Asa Fitch, then State Entomologist of New York, estimated the injury to amount to $15,000,000.00 in New York State alone. Serious damage was also done in 1857 and 1858.

There is probably but one brood each year, though some evidence has been produced to show that in certain seasons in some parts of the country there is a partial second brood.

Though wheat is usually the crop damaged, sometimes rye, barley, and oats are injured by this insect. Considerable damage to rye in 1917 was reported from certain portions of New York State.

Specimens of the same insect in winter wheat were received at this office on July 18 from Westport. The infested stalks were much shorter than the normal stalks. The adult is a small, two-winged fly which appears about the middle of June and lays

its eggs in a groove at the summit of the chaff. The eggs hatch in about a week and the maggots burrow into the kernels which are then forming. The maggots are of a reddish color and the insect is sometimes known as the "red weevil." The larvae enter the ground to pupate.

Dr. Felt states that there are no satisfactory control measures, but Sanderson advises burning the stubble, deep fall plowing and a rotation of crops.

Note Regarding Authorship.

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PLATE I.

a. Planting a colony of parasities. Groton.

b. Spraying to kill gipsy moth caterpillars.

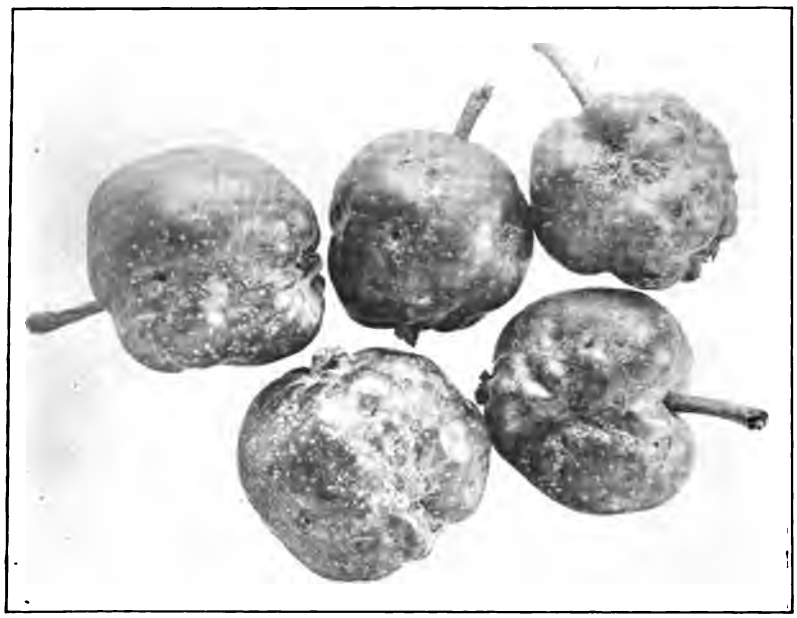
GIPSY MOTH WORK.

PLATE II.

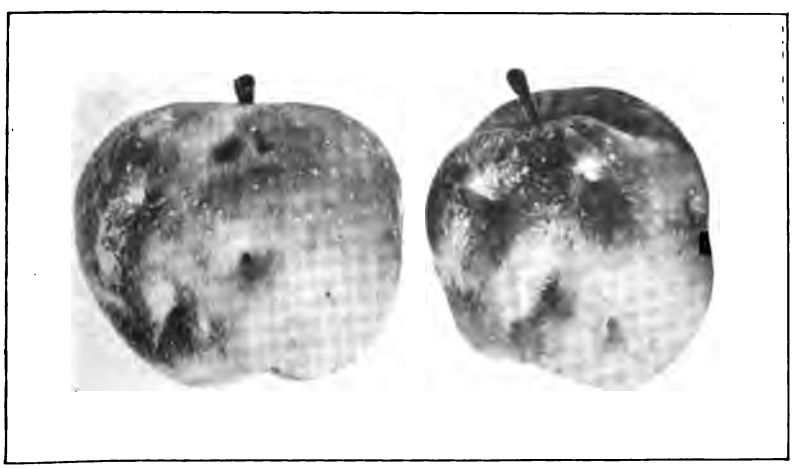
a. Apple leaves injured by the false red bug.
Leaves natural size, bug nearly three times enlarged.

b. Spraying to kill aphis and red bug.
Smith's orchard, Clintonville.

FALSE RED BUG.



a. Half-grown apples showing red bug injury.



b. Mature apples injured by red bugs early in the season.

FALSE RED BUG.

PLATE IV.

a. Eggs, as laid in the soil. Five times enlarged.

b. Striped cucumber beetle. Enlarged four times.

c. View at farm showing protectors over cucumber plants

STRIPED CUCUMBER BEETLE.

PLATE V.

Cucumber plants injured by the larvae of the striped beetle.
Natural size.

PLATE VI.

1. Adults, female and male, twice natural size; 2. Eggs in pine needle, about four times enlarged; 3. Cocoons, natural size; 4. Larvae feeding on pine, natural size.

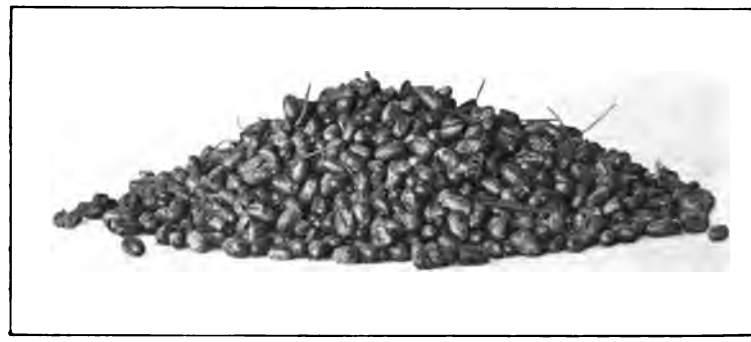
IMPORTED PINE SAWFLY.

Diprion simile: Hartig.

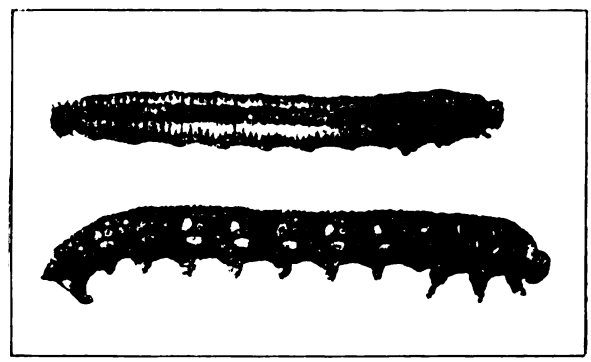
b. *Pinus cembra* about seven feet tall almost defoliated by larvæ.

a. Japanese or Bhotan pine, *Pinus excelsa*, partially stripped by larvæ.

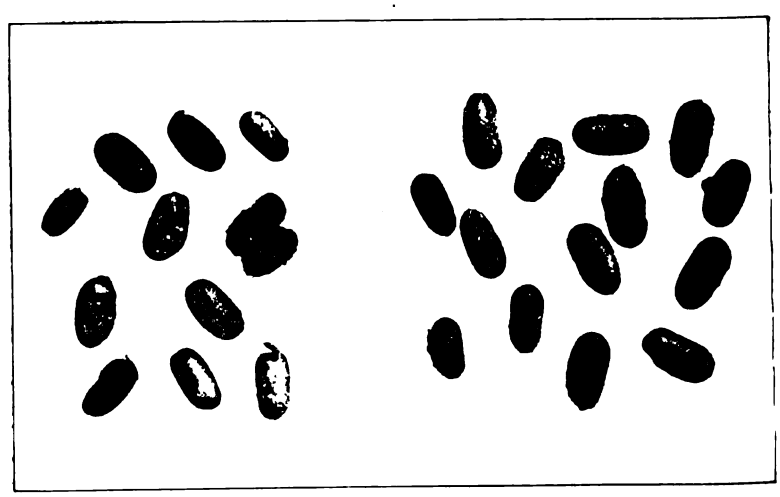
PLATE VIII.



a. A heap containing 1,617 cocoons, collected from pine twigs.

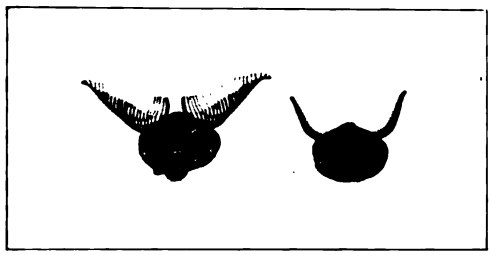


b. Dorsal and lateral view of larva, twice enlarged.

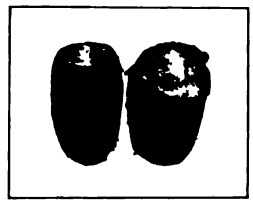


c. Cocoons at left have been torn open, probably by birds; those at right show exit holes of Chalcid parasite. Natural size.

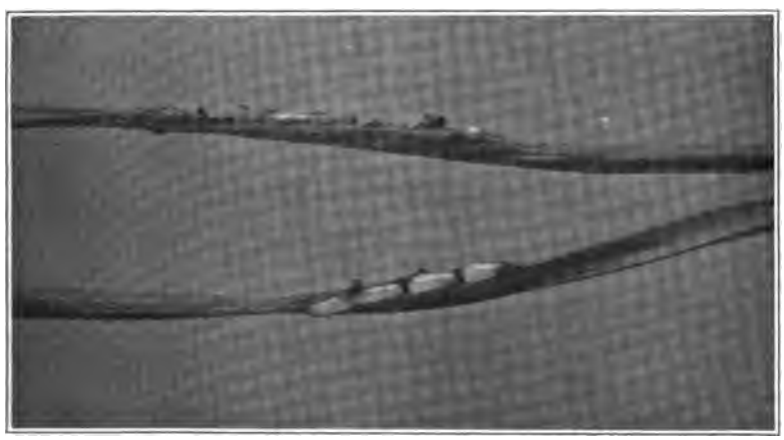
IMPORTED PINE SAWFLY.



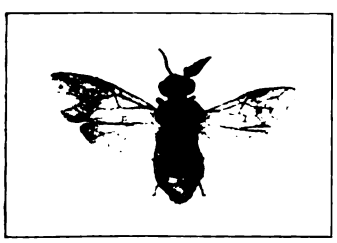
a. Male and female antennae. Four times enlarged.



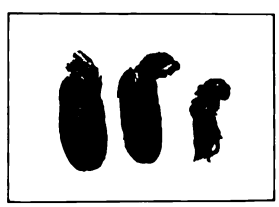
b. Old cocoons with new ones made inside them. Twice natural size.



c. Eggs laid in pine needles, four times enlarged.



d. Gynandromorph, left side like female, right like male. Twice enlarged.



e. Tachinid parasites which were unable to escape from cocoons. Twice enlarged.

IMPORTED PINE SAWFLY.

PLATE X.

b. Potato plant injured by aphids.

a. Growing tip of tomato badly infested with aphids. (After Houser, Guyton and Lowry, Ohio Agr. Expt. Sta., Bull. 317.)

POTATO APHID.

1 2 3

a. Three important predaceous enemies of the pink and green potato aphid. 1. Larva of lace-wing fly; 2. Lady beetle larva; 3. Larva of Syrphus fly. (After Houser, Guyton and Lowry, Ohio. Agr. Expt. Sta., Bull. 317.)

b. Potatoes killed by pink and green potato aphid, Hamilton County, Ohio (June 30, 1917.) (After Houser, Guyton and Lowry, Ohio Agr. Expt. Sta., Bull. 317.)

POTATO APHID.

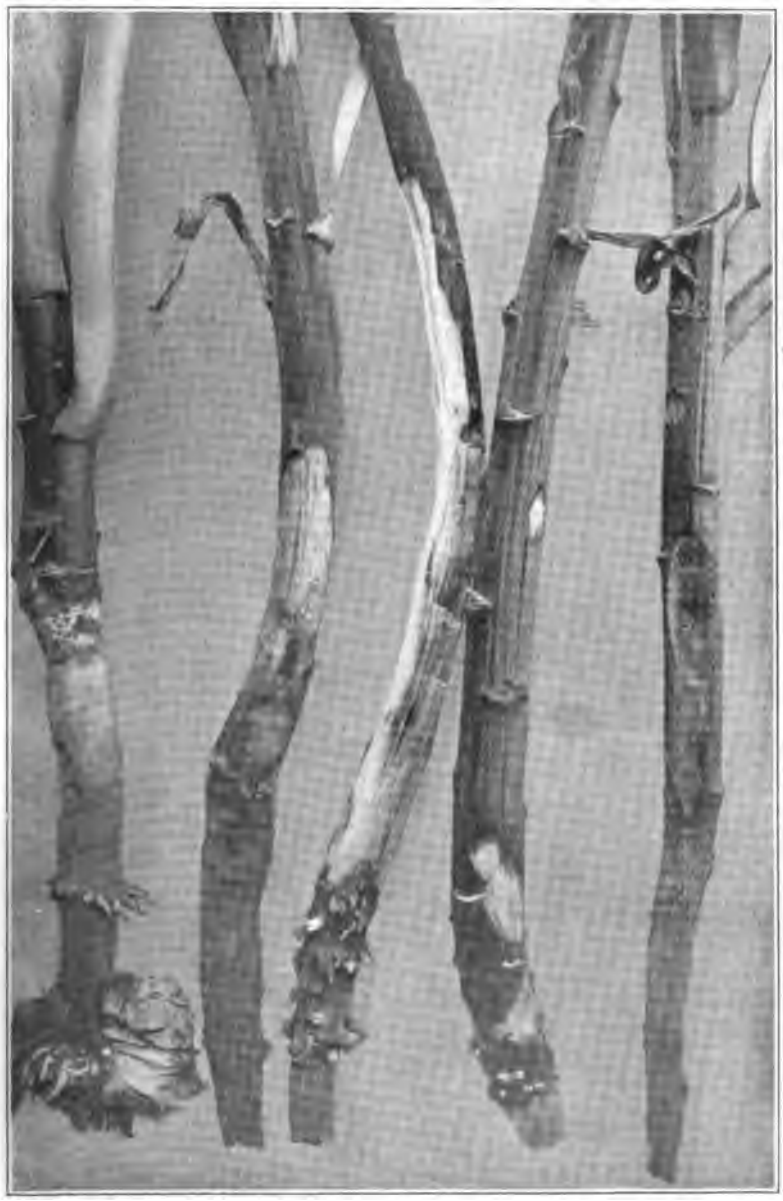
PLATE XII.

a. View in greenhouse, where cockroaches injured plants, Cromwell.

b. Rose plant with bark eaten off by cockroaches Natural size.

c. Egg-sac of cockroach. Twice enlarged.

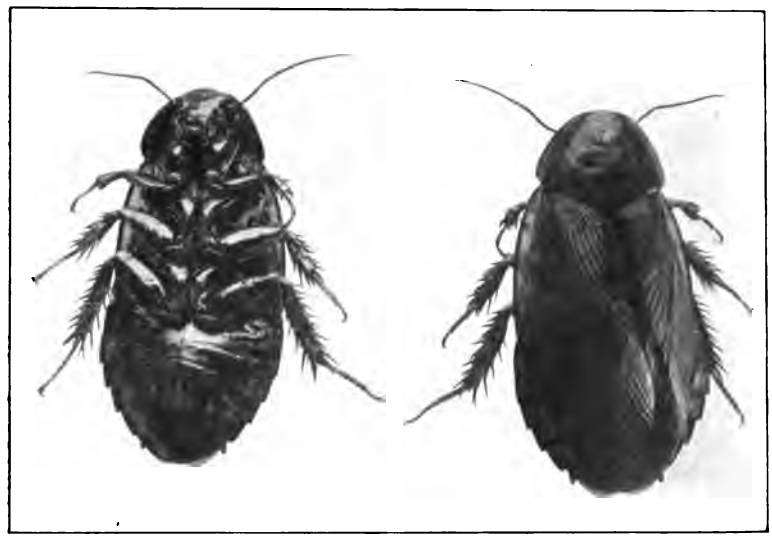
AN EXOTIC COCKROACH.



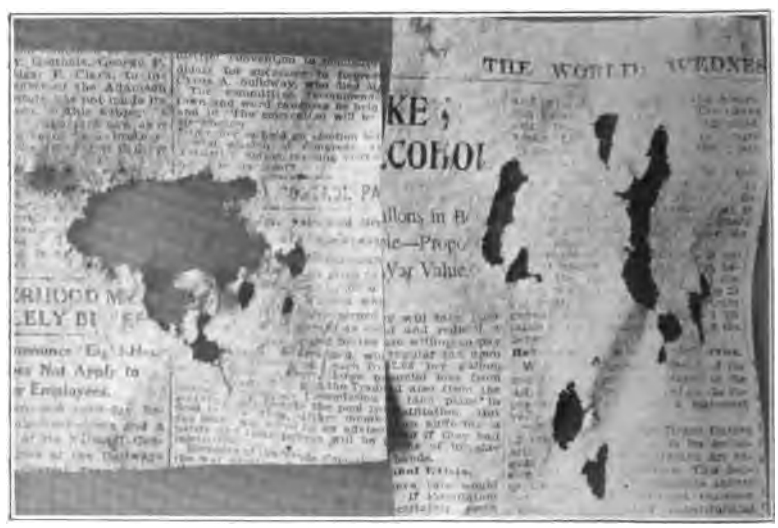
Easter lilies with bark and roots eaten by cockroaches. Natural size.

AN EXOTIC COCKROACH.

PLATE XIV.

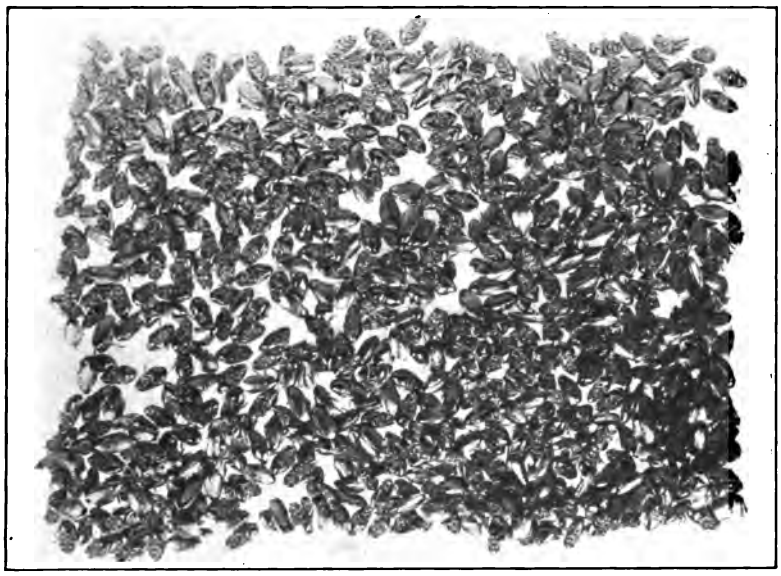


a. Adult female, ventral and dorsal view. Enlarged three times.



b. Holes in newspaper where cockroaches ate the cyanide bait. No dead roaches were found.

AN EXOTIC COCKROACH.



a. 708 dead cockroaches.

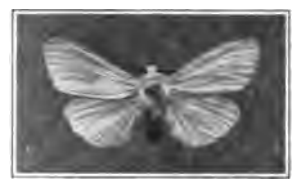
b. View looking downward in one of the walks, showing roaches killed by kerosene spray.

AN EXOTIC COCKROACH.

PLATE XVI.

a. Nests of fall web-worm. (After Slingerland.)

b. Egg-cluster on peach leaf. Natural size.



c. Adult female, natural size.

d. Young larvæ feeding on hickory leaf. Natural size.

FALL WEB-WORM.

a. Nest on chestnut.

b. Nest on hickory.

FALL WEB-WORM.

PLATE XVIII.

Hickory tree defoliated by the fall web-worm. New Canaan.

FALL WEB-WORM.

PLATE XIX.

a. Penultimate stage of caterpillars. Natural size.

b. Fully-grown caterpillar on leaf. Natural size.

c. Cocoon. Natural size.

d. Adult. Natural size.

HICKORY TUSSOCK MOTH.

PLATE XX.

a. Female and egg-cluster of hickory tussock moth. Natural size.

b. Larva of tessellated tussock moth. Natural size.

c. Trunk of maple tree showing tussock moth cocoons.

d. Young walnut caterpillars on hickory leaf. Natural size.

TUSSOCK MOTHS.

PLATE XXI.

a. Adult female. Natural size

b. Mature larva. Natural size.

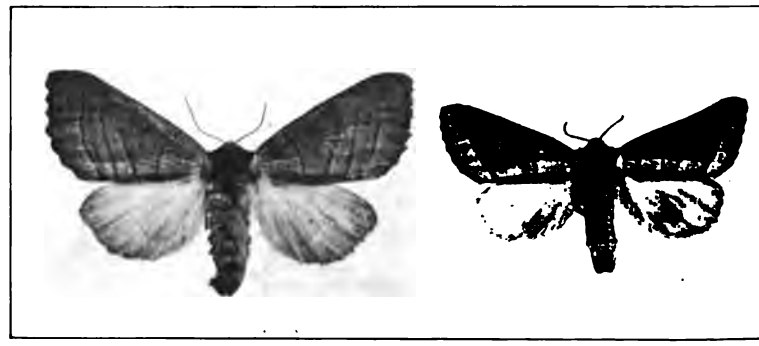
d. Cast skins on tree trunk.

c. Pupæ. Natural size.

e. Egg-cluster. Natural size.

WALNUT CATERPILLAR

PLATE XXII.



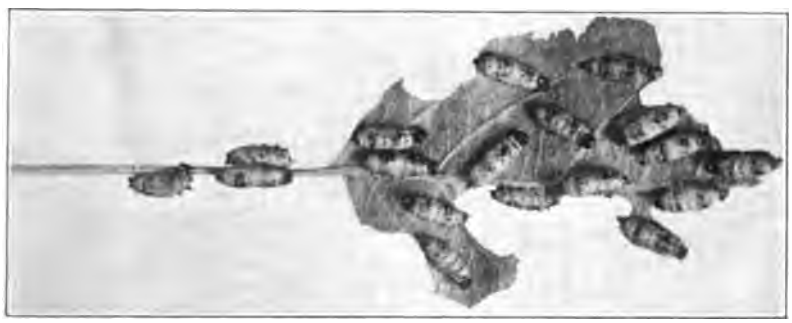
a. Adult female and male. Natural size.

b. Caterpillars on apple twigs. Natural size.

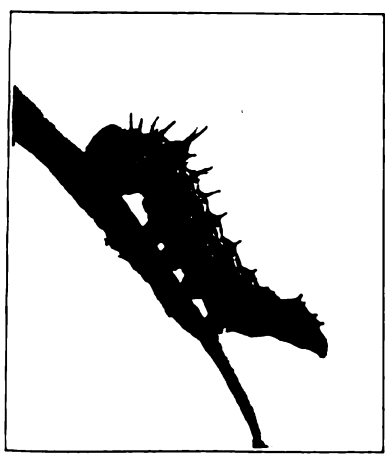
YELLOW-NECKED CATERPILLAR.

PLATE XXIII.

a. Adult female and male. Natural size.



b. Parasitized caterpillars. Natural size.

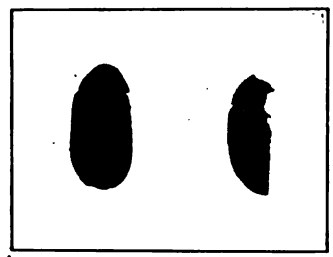


c. Mature caterpillar. Enlarged one and one-half times.

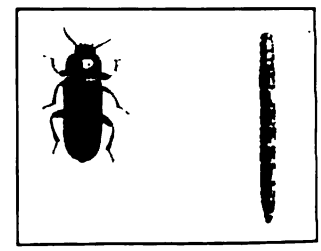
d. Young caterpillars. Natural size.

RED-HUMPED CATERPILLAR.

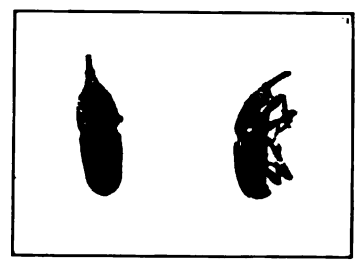
PLATE XXIV.



a. Drug store beetle. Adults. Four times enlarged.

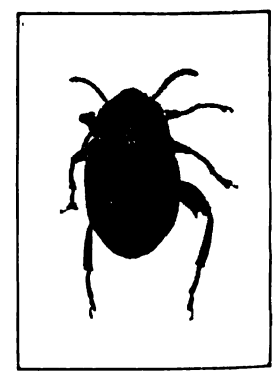


b. Common meal worm, adult and larva. Natural size.



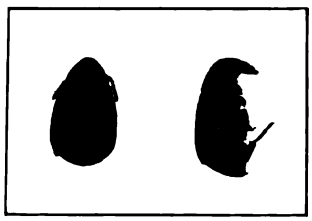
c. Rice weevil. Adults. Four times enlarged.

d. Cadelle, adult and larva. Twice natural size.



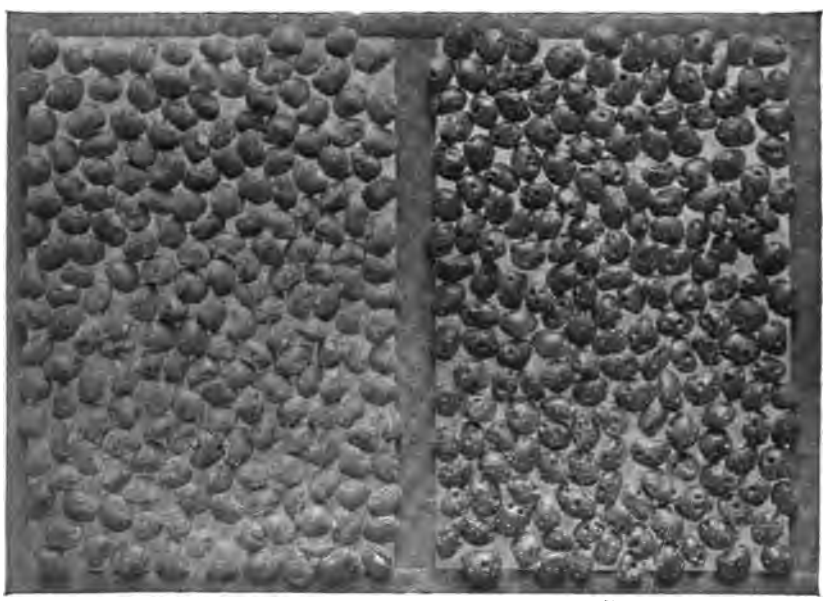
e. Pea weevil, adult beetle. Four times enlarged.

INSECTS ATTACKING STORED FOOD PRODUCTS.



a. Common bean weevil. Adult beetles. Four times enlarged.

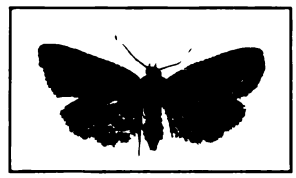
b. Infested cow peas, showing eggs and exit holes of bean weevil. Natural size.



c. Effect of air slaked lime. Treated seeds at r[redacted] (After Metcalf, North Carolina Agricultural Experiment Station. Jour. Econ. Ent., Vol. 10, plate 3, fig. 2.)

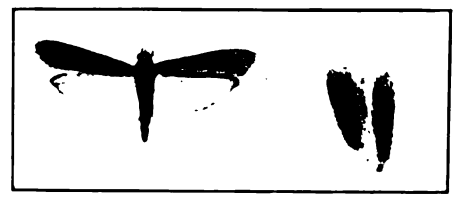
BEAN WEEVIL.

PLATE XXVI.



a. Meal snout moth. Natural size.

b. European grain moth. Three times enlarged.



c. Mediterranean flour moth and cocoons, slightly enlarged.

d. Seeds injured by the large cabinet beetle. Natural size.

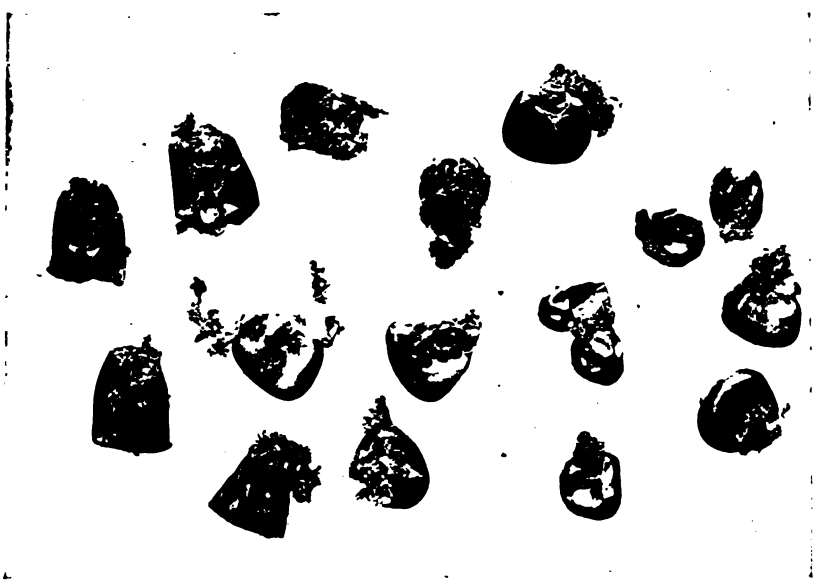
e. Ear of corn injured by the European grain moth. Half size.

INSECTS INJURING STORED FOOD PRODUCTS.

a. Peruvian seed corn injured by saw-toothed grain beetle. Reduced one-half.

b. Pop corn showing exit holes of Angoumois grain moth. Natural size.

c. Saw-toothed grain beetle. Four times enlarged.



d. Kernels of corn injured by the Indian meal moth. Natural size.

INSECTS INJURING STORED FOOD PRODUCTS.

PLATE XXVIII.

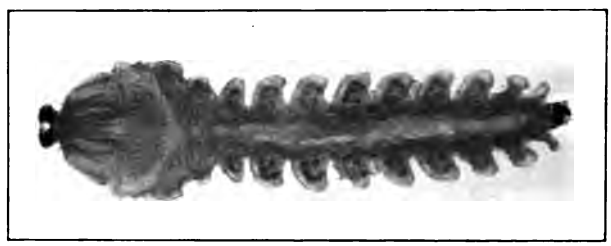
a. View in Quinnipiac Marsh, New Haven, before ditching.

b. Same view, after ditching.

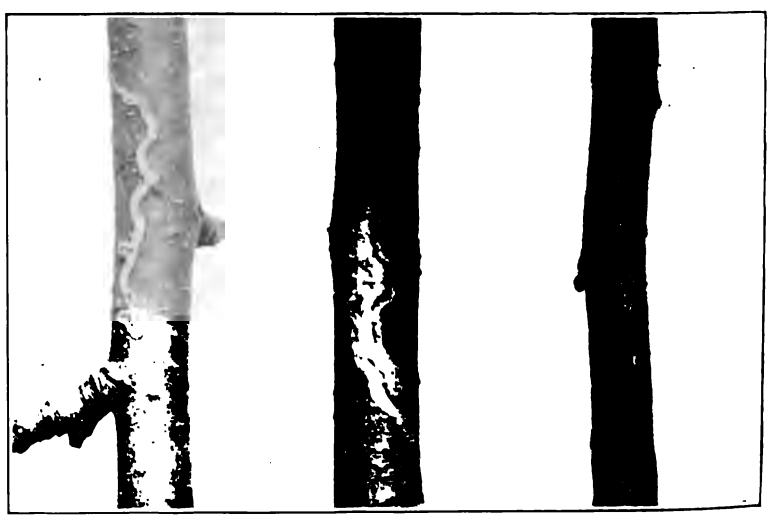
MOSQUITO ELIMINATION WORK.

PLATE XXX.

a. View in Quinnipiac marsh, showing workmen cleaning old ditch.



b. Larva of apple twig miner. Enlarged twelve times.

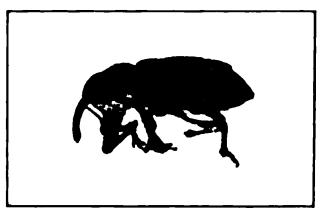


c. Mines in bark of apple twigs. Natural size.

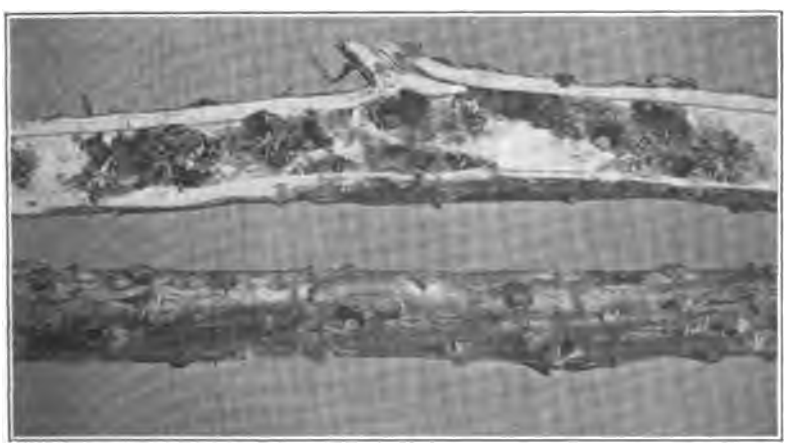
MOSQUITO ELIMINATION WORK AND APPLE TWIG MINER.

a. Larval nests of spiræa leaf roller. Natural size.

b. Adult of spiræa leaf roller. Twice enlarged.



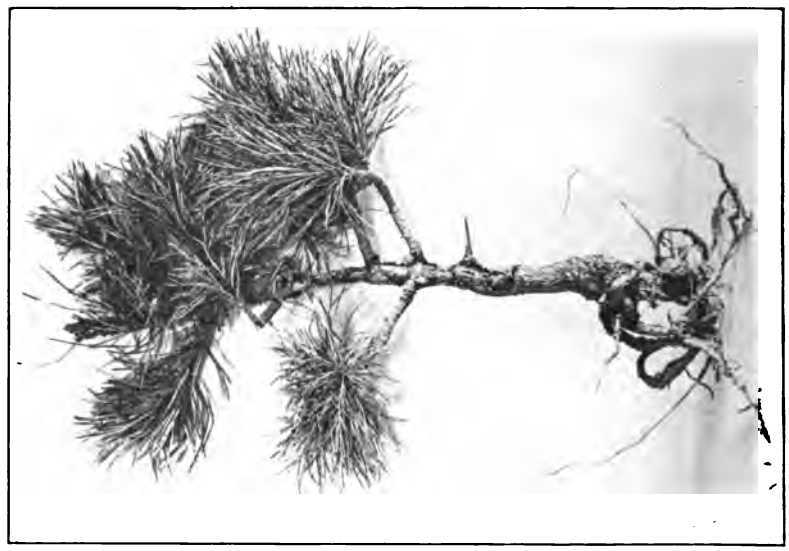
c. Larger pine weevil. Four times enlarged.



d. Stems of evening primrose tunneled by weevils. Natural size.

SPIRAEA LEAF ROLLER: LARGER PINE WEEVIL: INFESTED STEMS OF EVENING PRIMROSE.

PLATE XXXII.



b. Young stone pine, *Pinus cembra*, from nursery, injured by weevils.

a. Pupal cells in trunk of red pine.

WORK OF THE LARGER PINE WEEVIL.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 204 FEBRUARY, 1918

Fertilizer Report for 1917

By E. H. JENKINS, *Director and*
JOHN PHILLIPS STREET, *Chemist*
In Charge of the Analytical Laboratory

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Report on Commercial Fertilizers, 1917.

By E. H. Jenkins, *Director, and* John Phillips Street,
Chemist in Charge of the Analytical Laboratory.

During 1917 forty-four individuals and firms have entered for sale in this state 410 brands of fertilizers classified as follows:

Nitrogenous superphosphates with potash	167
Nitrogenous superphosphates without potash	160
Bone manures and tankage	34
Fish, blood, castor pomace and chemicals	49
Total	410

During the spring months V. L. Churchill, the sampling agent of the Station, visited about 100 towns and villages of the state and gathered samples of commercial fertilizers. These represented all the brands registered with the exception of the following:

Alpha Portland Cement Co.'s Alpha Potash-Lime Fertilizer; *American Agricultural Chemical Co.'s* Dissolved Acid Phosphate, H. G. Acid Phosphate, Grain and Seeding Fertilizer, Odorless Grass and Lawn Top Dressing Revised, Monarch Potato Manure, Great Harvest Potato Special, Lion Brand Potato Manure, Bradley's Eclipse Phosphate 1916, Bradley's Extra Potato and Root Special, Bradley's Northland Potato Grower, Bradley's Complete Manure for Top Dressing Grass and Grain, Bradley's Triplex Potato Special, East India Economizer Phosphate 1916, East India Pilgrim Fertilizer 1916, East India Mayflower 1916, Quinnipiac Corn Manure 1916, Quinnipiac Phosphate 1916, Williams and Clark's Royal Phosphate 1916, Williams and Clark's Matchless Fertilizer 1916; *Apothecaries Hall Co.'s* Victor Corn Phosphate; *Bowker's* Superphosphate with Ammonia 1%, Stockbridge Complete, Potato Phosphate 1916, Complete Alkaline Tobacco Grower 1916; *Clark's* Special Mixture; *Coe Mortimer's* Extra Special Potato Fertilizer Revised, 12% Blood Tankage; *James'* Ground Bone; *Lister's* Buyer's Choice Acid Phosphate, Valley

Brand Fertilizer 1916, Celebrated Tobacco Fertilizer; *Manchester's* 14% Acid Phosphate, Fine Ground Bone, Ground Tankage 9-20; *National* Ammoniated Phosphate 1916, Excelsior Potato Fertilizer, H. G. Top Dressing 1916.

A sample of the American Agricultural Chemical Co.'s Grain and Seeding Fertilizer, sent by a purchaser, was analyzed.

CLASSIFICATION OF FERTILIZERS ANALYZED.

1. *Containing nitrogen as the chief active ingredient:*

Nitrate of soda	9
Cotton seed meal	95
Castor pomace	8

2. *Containing phosphoric acid as the chief active ingredient:*

Basic lime phosphate	4
Precipitated bone phosphate	6
Precipitated phosphate	1
Acid phosphate	17
Phospho plaster	1
Barium phosphate	1

3. *Containing potash as the chief active ingredient:*

Muriate of potash	3
Cotton hull ashes	1

4. *Containing nitrogen and phosphoric acid:*

Fish manures	12
Tankage	13
Bone manures	21

5. *Mixed fertilizers:*

Nitrogenous superphosphates with potash	147
Nitrogenous superphosphates without potash	198

6. *Miscellaneous fertilizers and waste products:*

Sheep manure	6
Wood ashes	20
Household wastes	28
Limestone	5
Miscellaneous	29
Total	625

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA, OR SODIUM NITRATE.

As offered in the Connecticut market this year, nitrate of soda has contained an average of 15.44 per cent. of nitrogen, equivalent to 93.6 per cent. of pure sodium nitrate.

The following nine samples were analyzed:

9364. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

8944. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Stock of C. R. Treat, Orange.

8947. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

9333. Sold by Coe-Mortimer Co., New York City. Stock of J. E Stoddard, Abington.

9331. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of C. Buckingham, Southport.

8939. Sold by American Agricultural Chemical Co., New York City. Stock of G. S. Phelps & Co., Thompsonville.

9352. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

8942. Sold by Nitrate Agencies Co., New York City. Stock of E. B. Palmer, Bridgeport.

9361. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of A. W. Anderson, Northford.

ANALYSES OF NITRATE OF SODA.

Station No.....	**9364**	**8944**	**8947**	**9333**	**9331**	**8939**	**9352**	**8942**	**9361**
Per cent. of									
Nitrogen guaranteed.	15.00	15.00	15.00	15.00	14.80	15.00	15.00	15.00	15.00
Nitrogen found.....	15.52	15.20	15.48	15.44	15.32	15.34	15.34	15.56	15.78
Cost per ton.....	$70.00	70.00	73.00	73.00	85.00	88.00	90.00	....	90.00
Nitrogen costs cents per pound.....	**22.6**	**23.0**	**23.6**	**23.6**	**27.7**	**28.7**	**29.3**	**....**	**28.5**

The cost of nitrogen in nitrate of soda in small lots at retail has been on the average 26 cents per pound, 1 1-2 cents more than last year, and 9 or 10 cents more than in 1915.

COTTONSEED MEALS BELOW GUARANTY.—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled, or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Poe Cottonseed Products Co., Memphis.				
9046	.....	Amer. Sumatra Tob. Co., Hartford	6.05	6.17	.....
	J. E. Soper Co., Boston.				
8780	20769.....	Spencer Bros., Suffield.....	5.98	6.18	$39.00
	Southern Cotton Oil Co., Memphis.				
9163	28087.....	Conn. Tobacco Corp., Silver Lane	5.70	6.17	44.50
9164	60770.....	" " " " "	5.92	6.17	44.50
9013	133895.....	" " " " "	5.81	6.17	44.50
9014	24948.....	" " " " "	5.78	6.17	44.50
9015	151067.....	" " " " "	5.78	6.17	44.50
9016	151064.....	" " " " "	5.73	6.17	44.50
9017	151049.....	" " " " "	5.78	6.17	44.50
9012	151072.....	" " " " "	5.74	6.17	44.50
8823	36238.....	" " " " "	5.91	6.17	44.50
8824	151059.....	" " " " "	6.01	6.17	44.50
8802	16002.....	" " " " "	5.97	6.17	44.50
	Union Seed & Fert. Co.				
9158	40656.....	John Sullivan & Son, Suffield.....	6.00	6.17	42.50
	Virginia-Carolina Chem. Co. N. Y. City.				
9458	27871.....	Conn. Tobacco Corp., Silver Lane	5.46	5.76	46.00
9459	36400.....	" " " " "	5.42	5.76	46.00
9460	87114.....	" " " " "	5.52	5.76	46.00

CASTOR POMACE.

This is a residue from the manufacture of castor oil and is used chiefly as a tobacco fertilizer. Experience indicates that it is a little slower in its action than cotton seed meal and that it gives a somewhat heavier quality to the tobacco leaf. Stock will eat it greedily if they have the chance, but it is extremely poisonous.

The following eight samples were analyzed:

8940. Sold by American Agricultural Chemical Co., New York City. Stock of C. F. Allen, Warehouse Point.

8871. Sold by Apothecaries Hall Co., Waterbury. Sampled and sent by Karl C. Kulle, Suffield.

9330. Sold by Apothecaries Hall Co., Waterbury. Stock of W. J. Reeves, Windsorville.

9350. Sold by Baker Castor Oil Co., New York City. Stock of Olds & Whipple, Hartford.

9332. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of W. N. Pinney, Rockville.

9390. Sold by Coe-Mortimer Co., New York City. Stock of M. C. Griffin, East Granby.

9360. Sold by Olds & Whipple, Hartford. Stock of J. N. Lasbury, Broad Brook.

8945. Sold by Spencer Bros., Suffield. Sampled at factory.

ANALYSES OF CASTOR POMACE.

Station No.....	**8940**	**8871**	**9330**	**9350**	**9332**	**9390**	**9360**	**8945**
Per cent. of								
Nitrogen guaranteed	4.53	5.00	4.52	4.50	4.52	4.53	5.00	4.84
Nitrogen found...	4.65	3.45	4.61	4.75	4.71	4.66	5.06	4.91
Cost per ton.....	$32.25	32.00	34.00	31.00	31.00	28.00	32.00	30.00

In sample **9350** one per cent. each of phosphoric acid and potash was guaranteed; the sample contained 1.46 per cent. of phosphoric acid but only 0.45 per cent. of water-soluble potash.

Sample **8871** was 1.55 per cent. deficient in nitrogen.

The average nitrogen content of the samples was 4.60 per cent. and the average cost per ton, $31.28.

Assuming a value of 4 cents per pound for phosphoric acid and 25 cents per pound for potash, the average cost of nitrogen per pound in castor pomace this year was 27.3 cents, or $5.46 per unit.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

BASIC LIME PHOSPHATE.

Shipments of basic phosphate from abroad have been almost cut off on account of the war. As a substitute for basic phosphate a product called "basic lime phosphate" has been put on the market, of which we have analyzed four samples of two brands. "Available phosphoric acid" was determined by the so-called Wagner method.

9367. Basic Lime Phosphate. Sold by American Agricultural Chemical Co., New York City. Stock of C. R. Main, Norwich.

9469. Same brand as **9367.** Stock of W. P. Chipman & Son, Talcottville:

9370. Basic Fruit and Legume Phosphate. Sold by Coe-Mortimer Co., New York City. Stock of Willis Smith, Winsted.

9434. Same brand as **9370.** Stock of A. T. Henry, Wallingford.

ANALYSES OF BASIC LIME PHOSPHATE.

Station No.	9367	9469	9370	9434
Per cent. of				
Total phosphoric acid	14.29	14.10	14.02	15.65
"Available" phosphoric acid guaranty	13.00	12.00	13.00	13.00
"Available" phophoric acid found	11.81	11.71	12.28	13.13
Cost per ton	....	$22.00	....	15.00

One sample of each brand contained less "available" phosphoric acid than was guaranteed.

PRECIPITATED BONE PHOSPHATE.

This is a manufacturing by-product and consists of fine precipitated phosphate of lime, neutral in reaction, and contains no nitrogen. It is very readily soluble in ammonium citrate solution and is quickly available to crops. It is at present chiefly used as a tobacco fertilizer.

Six samples were analyzed, all of which were sold by Olds and Whipple, Hartford. **9371** was sampled by the Station at the factory, and **9373** by the Station from the stock of F. T. Phelps, Suffield; **8711, 8712** and **8742** were sampled and sent by the seller; **8872** was sampled and sent by Karl C. Kulle, Suffield. The respective car numbers for the last four samples were 88300, 73792, 4822 and 73365.

The guaranty for the material was 28 per cent. "available" and 32 per cent. total phosphoric acid.

ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	9371	9373	8711	8712	8742	8872
Per cent. of						
Water-soluble phosphoric acid	1.56	1.33	1.41	1.37	1.01	1.50
Citrate-soluble phosphoric acid	29.98	27.98	28.67	28.44	30.65	29.10
Citrate-insoluble phosphoric acid	8.02	7.61	6.00	6.49	8.64	7.02
Total phosphoric acid	39.56	36.92	36.08	36.30	40.30	37.62
"Available" phosphoric acid	31.54	29.31	30.08	29.81	31.66	30.60

The above samples sold at the rate of $1.40 to $1.50 per unit of "available" phosphoric acid, or from 7.0 to 7.5 cents per pound.

PRECIPITATED PHOSPHATE.

9369. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of W. N. Pinney, Rockville. Cost $30.00 per ton. Guaranteed 22 per cent. "available" phosphoric acid. It contained

Water-soluble phosphoric acid	5.43
Citrate-soluble phosphoric acid	18.78
Citrate-insoluble phosphoric acid	0.95
Total phosphoric acid	25.16
"Available" phosphoric acid	24.21

"Available" phosphoric acid cost 6.2 cents per pound.

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

This material is made by treating mineral phosphates or phosphate rock with oil of vitriol (sulphuric acid), which converts the larger part of the phosphoric acid into forms soluble in water, and at the same time changes into sulphate of lime a large part of the lime which was previously combined with phosphoric acid.

The guaranty usually gives the percentage of "available" phosphoric acid. This is only a trade name for the sum of the water-soluble and citrate-soluble phosphoric acid. Its amount gives no certain indication of the actual availabliity of this phosphoric acid to crops. In acid phosphate, however, well made from domestic rock, it is fair to assume that the larger part of the "available" is also agriculturally available.

The following seventeen samples were analyzed:

9353. Sold by E. Manchester & Sons, Winsted. Stock of H. H. McKnight, Ellington.

9328. Sold by L. T. Frisbie Co., New Haven. Stock of H. G. Cooke, Branford.

9356. Sold by Virginia-Carolina Chemical Co., New York City. Stock of Tanner & Wilcox, Winsted.

8943. Sold by Nitrate Agencies Co., New York City. Stock of Edward White, Rockville.

9324. Sold by Armour Fertilizer Works, Chrome, N. J. Stock of Edward White, Rockville.

8816. Sold by L. T. Frisbie Co., New Haven. Sampled and sent by F. W. Browning, Norwich.

8938. Sold by American Agricultural Chemical Co., New York City. Stock of L. F. Burr, Branford.

9322. Sold by American Agricultural Chemical Co., New York City. Stock of J. A. Glasnapp, West Cheshire.

8946. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

8937. Sold by American Agricultural Chemical Co., New York City. Stock of L. F. Burr, Branford.

9327. Sold by Coe-Mortimer Co., New York City. Stock of J. E. Stoddard, Abington.

9351. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

9321. High Grade Soluble Phosphate. Sold by Coe-Mortimer Co., New York City. Stock of Joseph Humphreys, Danbury.

9326. Soluble Phosphate, Sold by Bowker Fertilizer Co., New York City. Stock of A. R. Manning, Yantic.

9355. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of W. Howard, Windsor.

8941. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

8760. Plain Superphosphate. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled and sent by A. B. Smith, Clintonville. Suspected of containing added lime. 27.88 per cent. was present, not an abnormal amount.

ANALYSES OF ACID PHOSPHATE.

Station No.	Water-soluble phosphoric acid.	Citrate-soluble phosphoric acid.	Citrate-insoluble phosphoric acid.	Total phosphoric acid.	"Available" phosphoric acid found.	"Available" phosphoric acid guaranteed.	Cost per ton.	"Available" phosphoric acid costs cents per pound.
9353	13.87	3.87	1.39	19.13	17.74	16.0	$18.50	5.2
9328	13.36	2.31	0.74	16.41	15.67	14.0	17.00	5.4
9356	15.96	1.77	0.27	18.00	17.73	16.0	19.00	5.4
8943	15.41	1.29	0.86	17.56	16.70	16.0	18.50	5.5
9324	14.83	1.64	0.52	16.99	16.47	16.0	18.50	5.6
8816	16.42	1.15	0.29	17.86	17.57	16.0	20.00	5.7
8938	14.29	2.81	0.82	17.92	17.10	16.0	21.00	6.1
9322	11.02	6.71	0.64	18.37	17.73	18.0	22.50	6.3
8946	15.05	2.22	0.13	17.40	17.27	16.0	22.00	6.4
8937	9.48	5.85	0.79	16.12	15.33	14.0	20.00	6.5
9327	12.71	3.96	0.36	17.03	16.67	16.0	22.00	6.6
9351	15.92	1.25	0.78	17.95	17.17	16.0	23.00	6.7
9321	10.84	4.70	0.49	16.03	15.54	14.0	22.00	7.1
9326	9.96	4.79	0.50	15.25	14.75	14.0	24.00	8.1
9355	13.03	3.41	0.36	16.80	16.44	16.0	....	..
8941	12.44	2.10	0.50	15.04	14.54	14.0	....	..
8760	....	....	....	17.00	....	....	....	..

One of the above samples was guaranteed 18 per cent. "available"; ten were guaranteed 16 per cent., and five 14 per cent.

The average cost of "available" phosphoric acid in the above samples was 6.2 cents per pound, about 0.75 cents less than last year.

PHOSPHO PLASTER.

9368. Sold by American Agricultural Chemical Co., New York City. Stock of A. L. Burdick, Westbrook. Guaranteed 2 per cent. "available" phosphoric acid. It contained

Water-soluble phosphoric acid	2.03
Citrate-soluble phosphoric acid	2.63
Citrate-insoluble phosphoric acid	2.21
Total phosphoric acid	6.87
"Available" phosphoric acid	4.66
Lime (calcium oxid)	31.93

BARIUM-PHOSPHATE.

9408. Sold by Witherbee, Sherman & Co., Port Henry, N. Y. Stock of Station Farm, Mt. Carmel. Guaranteed 14 per cent. phosphoric acid, 7 per cent. barium sulphid.

It contained 15.34 per cent. phosphoric acid, chiefly in insoluble forms.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

Owing to the war very little, if any, potash has been shipped to this country during the past three years. The three samples of muriate of potash analyzed represented stock in the hands of farmers who were tempted by the abnormally high prices to dispose of their surplus stock.

MURIATE OF POTASH.

8691, 8692. Stock of Samuel Wilson, Waterbury. They contained 53.92 and 52.44 per cent. of potash, respectively.

8801. Stock of W. T. Peters, Cheshire. It contained 58.24 per cent. of potash.

COTTON HULL ASHES.

9279. Sold by Olds and Whipple, Hartford. Car No. 22120; stock of Windsor Tobacco Growers Corporation, Windsor. Cost $6.00 per unit of water-soluble potash, equivalent to 30 cents per pound for actual potash. It contained 24.78 per cent. of potash.

IV. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

The twelve samples analyzed show considerable uniformity in the content of nitrogen, which ranges from 7.28 to 9.75 per cent., with an average of 8.34 per cent. The phosphoric acid, however, shows a wide range, from 2.75 to 10.41 per cent., with an average of 6.77 per cent. Six of the samples failed to meet their guaranties, two being deficient in nitrogen, one in phosphoric acid, and three in both of these elements. **9365** and **9100** contained only about half of the phosphoric acid guaranteed.

The average cost was $53.44 per ton, about $2 higher than last year. If the phosphoric acid were valued at 4 cents per pound, the nitrogen cost on the average 28.8 cents per pound; if at 6 cents per pound, the nitrogen cost 27.2 cents.

ANALYSES OF

Station No.	Manufacturer	Dealer or Purchaser
	Sampled by Station:	
8921	Amer. Agr. Chem. Co.	C. O. Treat, Manchester.
9045	Amer. Agr. Chem. Co.	C. K. Hale, Chicopee.
9323	Amer. Agr. Chem. Co.	Spencer Bros., Suffield.
9365	Apothecaries Hall Co.	Factory.
9325	Berkshire Fert. Co.	Factory.
9374	E. D. Chittenden Co.	F. T. Phelps, Suffield.
9357	International Agr. Corp.	S. B. Smith, East Haven.
8924	Olds and Whipple.	J. Gamble, Thompsonville.
9354	Olds and Whipple.	Factory.
8925	F. S. Royster Guano Co.	S. J. Orr, West Suffield.
	Sampled by Purchaser:	
9100*	L. T. Frisbie Co.	John Leonard, Burnside.
8873	Olds and Whipple.	K. C. Kulle, Suffield.

* Contained 3.10 per cent. chlorin.

TANKAGE.

(*Analyses on pages 386 and 387.*)

This material, made from the waste of slaughter houses and meat markets, naturally shows considerable differences in composition, depending upon the relative amounts of meat and bone present.

The thirteen samples analyzed fall into two quite well-defined groups, the one containing from 4.26 to 5.67 per cent. of nitrogen and from 14.06 to 21.42 per cent. of phosphoric acid, the other containing from 7.16 to 8.34 per cent. of nitrogen and from 5.62 to 11.19 per cent. of phosphoric acid.

The samples of the first group, approximately 6-30 grade, cost from $28 to $42 per ton; the higher grade tankages, 9-20, cost from $48 to $55 per ton.

The average composition and cost of the two grades were as follows:

Grade.	Nitrogen.	Phosphoric Acid.	Cost per Ton.
6–30	4.78	17.39	$35.33
9–20	7.83	7.96	51.00

Only four of these samples could be called fine, having 50 per cent. or more by weight in particles smaller than 1-50 inch.

Two samples failed to meet their nitrogen guaranty, one that for phosphoric acid, and one was deficient in both nitrogen and phosphoric acid.

FISH MANURES.

Nitrogen				Phosphoric Acid.			Total Phosphoric Acid.		
As Ammonia	As Organic	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Cost per ton.
0.20	7.77	7.97	8.23	0.85	5.03	0.36	6.24	6.0	$55.00
0.22	7.90	8.12	8.23	0.37	7.10	2.94	10.41	6.0	.....
0.19	7.81	8.00	8.23	0.65	4.01	0.75	5.41	6.0	55.00
0.14	7.62	7.76	8.20	0.25	2.24	0.26	2.75	5.5	48.00
0.24	8.23	8.47	8.23	0.40	5.04	1.74	7.18	6.0	57.00
2.23	5.05	7.28	8.00	0.18	4.02	0.83	5.03	6.0	52.00
0.23	8.01	8.24	8.20	0.32	4.87	2.09	7.28	....	.....
0.13	9.41	9.54	8.23	0.38	5.81	1.68	7.87	5.5	55.00
0.25	8.69	8.94	8.23	0.80	5.53	1.51	7.84	5.5	55.00
0.11	8.15	8.26	8.23	0.50	4.61	1.41	6.52	5.0	.....
....	....	7.71	7.41	....	....	....	6.95	14.0	50.00
....	....	9.75	8.23	....	....	....	7.82	5.5	54.00

ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
8922	Amer. Agr. Chem. Co.	Spencer Bros., Suffield.
9366	Apothecaries Hall Co.	Factory.
9461	Atlantic Packing Co.	Frank S. Platt Co., New Haven.
9334	Coe-Mortimer Co. (6–30)	Willis Smith, Winsted.
9335	Conn. Fat Rend. and Fert. Corp.	Factory.
9336	L. T. Frisbie Co.	Factory.
8923	L. T. Frisbie Co.	Knowles, Lombard Co., Guilford.
9358	Lister's Agr. Chem. Works (Celebrated Ground Bone and Tankage)	S. J. Orr, West Suffield.
9359	E. Manchester & Sons.	H. H. McKnight, Ellington.
9362	Sanderson Fert. & Chem. Co.	W. H. Burr, Westport.
9363	Sanderson Fert. & Chem. Co.	Factory.
8926	Wilcox Fertilizer Co.	Factory.
8948		S. D. Woodruff Sons, Orange.

BONE MANURES.

(Analyies on pages 388 and 389.)

The analyses of twenty-one samples of bone are given in the table. "Bone," like tankage, has a wide range of composition, some samples being from raw bone with or without much adhering meat and cartilage, others representing bone which has been cooked, the grease and nitrogenous matter being partially removed.

The average per cent. of nitrogen in these samples is 3.40 and of phosphoric acid 23.35. The average cost per ton, barring the exceptional prices of **9393** and **9387**, was $40.60.

Two samples failed to meet their nitrogen and two their phosphoric acid guaranties.

V. MIXED FERTILIZERS.

NITROGENOUS SUPERPHOSPHATES.

REGARDING GUARANTIES.

The following tables, pages 394 to 415, present 375 analyses.

Of those sampled by the Station Agent 143 are guaranteed to contain potash. 172 contain no potash. Three brands were

TANKAGE.

Nitrogen.				Phosphoric Acid.		Mechanical Analysis.		
As Ammonia.	As Organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
0.39	5.28	5.67	4.94	14.06	13.73	40	60	$38.00
0.13	5.52	5.65	4.94	16.76	13.73	38	62	36.00
0.17	6.99	7.16	7.41	7.18	9.15	50	50	50.00
0.46	5.19	5.65	4.94	14.78	13.73	44	56	.....
0.20	4.06	4.26	3.00	21.42	20.00	59	41	28.00
0.22	4.46	4.68	4.92	15.62	15.00	18	82	42.00
0.22	7.35	7.57	7.38	11.19	10.00	24	76	48.00
0.14	2.56	2.70	2.67	13.85	12.00	56	44	.....
0.41	4.56	4.97	4.93	19.33	13.73	45	55	33.00
0.33	4.51	4.84	4.94	20.20	13.73	64	36	.....
0.29	4.34	4.63	4.94	20.46	13.73	62	38	35.00
0.24	7.99	8.23	8.24	5.62	8.00	28	72	55.00
0.28	8.06	8.34	....	5.86	.....	33	67	.....

guaranteed to contain four per cent. of potash, though only one had nearly that amount. Seven brands guaranteed 3 per cent., nineteen 2, and the rest 1 per cent. or less.

Of the brands containing potash about 23 per cent. failed to meet their guaranty in one ingredient, while of the 172 without potash 16.8 per cent. failed in the same way.

In a large number of cases, however, a shortage of one ingredient was made good by an overrun of another, so that the buyer received full value for his money, but in the following brands this was not the case. Reckoning nitrogen at 27 cents, available phosphoric acid at 6 and potash at 30 cents per pound, respectively, the deficiency in money value per ton was:

No.	Name of Brand	Deficiency in Ton Value
9213	Armour's Bidwell's 3–8–1	$1.88
9299	" 5–8–4 Fertilizer	4.65
9290	" 7–6–1 "	3.83
9240	Bowker's Complete	9.52
9293	Coe-Mortimer's Red Brand Excelsior	3.50
9405	National Fertilizer Co.'s Extra H. G. Potato	1.81
9039	Rogers & Hubbard Co.'s Bone Base Soluble Potato	1.68
9306	A. A. C. Co.'s H. G. Grass Top Dressing	1.80
9316	Atlantic Packing Co.'s Tobacco Special	1.17
9130	International Agr'l Corp's. Buffalo Top Dresser	3.15
9131	" " " Vegetable and Potato	1.99
9173	N. E. Fertilizer Co.'s Potato Fertilizer	1.26

ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station:	
9376	Amer. Agr. Chem. Co., Fine Ground Bone..	L. F. Burr, Branford.....
9377	Apothecaries Hall Co., Bone.....	Factory.....
9378	Armour Fertilizer Works, Bone Meal.....	Brower & Malone, Norwalk.....
9379	Berkshire Fertilizer Co., Fine Ground Bone.	Wheeler & Co., Bridgeport.....
9380	Bowker Fertilizer Co., Fresh Ground Bone..	A. L. Burdick, Westbrook.....
9381	Coe-Mortimer Co., Fine Ground Bone.....	J. E. Stoddard, Abington.....
9375	L. T. Frisbie Co., Fine Bone Meal.....	Lightbourn & Pond, New Haven.
9414	L. T. Frisbie Co., Bone Meal.....	Frank S. Platt Co., New Haven.
9382	Lister's Agr. Chem. Works, Bone Meal.....	F. C. Benjamin, Danbury.....
9383	Lowell Fertilizer Co., Ground Bone.....	Geo. S. Phelps & Co., Thompsonville
9385	Rogers & Hubbard Co., Hubbard's Pure Raw Knuckle Bone Flour.....	E. A. Buck, Willimantic.....
9384	Rogers & Hubbard Co., Hubbard's Strictly Pure Fine Bone.....	J. P. Barstow & Co., Norwich....
9393	Rogers & Hubbard Co., Rogers' Knuckle Bone Flour.....	Cadwell & Jones, Hartford.....
9392	Rogers & Hubbard Co., Rogers' Pure Fine Ground Bone.....	Factory.....
9386	F. S. Royster Guano Co., Fine Ground Bone Meal.....	S. J. Orr, West Suffield.....
9387	Sanderson Fert. & Chem. Co., Fine Ground Bone.....	W. H. Burr, Westport.....
9388	M. L. Shoemaker & Co., Swift-Sure Bone Meal.....	Olds & Whipple, Hartford.....
9389	Wilcox Fertilizer Co., Pure Ground Bone..	Factory.....
	Sampled by Purchaser:	
8829	Apothecaries Hall Co., Bone.....	H. B. Cornwall, Meriden.....
9024	Bowker Fertilizer Co., High Grade Ground Bone.....	James O'Connor, Wethersfield..
8775	L. T. Frisbie Co., Bone Meal.....	H. W. Ferry, So. Glastonbury..

* Car lot.

QUALITY OF PLANT FOOD IN NITROGENOUS SUPERPHOSPHATES.

The potash given in the analyses is all water-soluble and available to crops.

The same is true of the "soluble" phosphoric acid. The "citrate-soluble" phosphoric acid, which with the water-soluble is called "available" by trade usage, is doubtless more promptly available to crops than the insoluble, although there are probably

BONE MANURES.

Nitrogen.		Phosphoric Acid.		Mechanical Analysis.		
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
3.15	2.47	21.38	22.88	41	59	$38.00
3.21	2.47	23.98	22.00	59	41	36.00
3.12	2.47	25.08	22.00	53	47	45.00
3.08	2.50	22.32	20.00	44	56	40.00
2.58	2.47	24.36	22.88	51	49	42.00
3.12	2.47	24.00	22.88	51	49	.....
3.17	2.46	25.10	20.00	45	55	44.00
4.09	3.93	20.58	21.39	35	65	44.00
3.64	2.47	23.20	23.00	57	43	40.00
2.47	2.46	26.18	20.00	69	31	37.00
3.94	3.82	25.08	24.70	39	61	.....
3.27	3.50	21.08	20.00	62	38	41.00
3.88	3.82	25.16	24.70	71	29	55.00
3.40	3.50	20.14	20.00	41	59	.....
2.61	2.47	23.48	22.90	50	50	40.00
2.23	2.47	21.64	20.00	65	35	*34.00
6.26	4.53	20 64	20.00	56	44	47.00
2.74	2.46	26.26	22.00	51	49	41.00
4.93	....	18.86	.....	80	20	.....
3 69	3.29	25.07	20.50	46	54	39.00
2.84	2.46	26.71	20.00	..	..	35.00

very considerable differences in the agricultural value of citrate-soluble phosphoric acid from different sources or materials. The same is true, also, of insoluble phosphoric acid. Thus, the insoluble phosphoric acid of bone is much more quickly available to crops than that from phosphate rock or apatite.

It is safest to give preference to those mixed fertilizers in which the proportion of insoluble phosphoric acid is small.

Regarding nitrogen, that which is in form of nitrates is the

BRANDS IN WHICH INFERIOR FORMS OF NITROGEN ARE INDICATED.

Station No.	Brand.	Organic Nitrogen.					
		Total.	Water-soluble.	Active-insoluble.	Inactive-insoluble.	Per cent. active insoluble by Alkaline Method.	Per cent. active insoluble by Neutral Method.
9117	Armour's Wheat, Corn and Oats Special...	0.81	0.25	0.27	0.29	48.0	74.4
8980	Armour's 1–8–2 Fertilizer.....	0.80	0.25	0.15	0.40	28.0	47.6
9282	Royster's Dreadnaught Fertilizer.....	0.78	0.33	0.19	0.26	42.2	74.4
8918	Royster's Logical Compound.....	1.39	0.60	0.34	0.45	42.6	83.6
8972	Mapes' 5% Ammonia Special	0.59	0.09	0.22	0 28	44.4	76.2

most quickly and completely available. As a rule the nitrogen of ammonia salts is less quickly and completely available than that of nitrates, but ranks next to it.

The organic nitrogen of fertilizers is supplied by a great variety of materials which differ very considerably in agricultural value.

The details of the methods used to detect very inferior forms of nitrogen have been given in previous reports.

By the alkaline permanganate method forms of organic nitrogen are considered inferior in which less than 50 per cent. of the water-insoluble, organic nitrogen is soluble in the reagent. By the neutral permanganate method, any solubility of less than 80 per cent. is suspicious. Some objection has been made to the method because dried horse and sheep manure, recognized as good fertilizers are ranked as inferior by these methods. It is true that both have agricultural value, but this depends to a considerable extent on the favorable action in the soil of the decomposing vegetable matter, while experiment has shown that the organic nitrogen in them is less available than in the forms ordinarily used in the compounding of fertilizers.

In the following brands inferior forms of nitrogen are indicated by both methods:

Regarding Prices of Nitrogenous Superphosphates.

The dealers' quotation of the cash ton price was obtained in most cases when each sample was drawn. These prices are, however, no real guide to prospective purchasers. The manufacturer has little or no control over the price which the retailer or agent will charge and the latter sells to the consumer according to special terms made with him, which are largely governed by time of payment and knowledge of the consumer's financial standing and habits. To take a concrete case: To-day a 2-10-0 formula can be bought for $40. That is called the "cash ton price."

But if paid for before Feb. 1 its price will be $37; if before Apr. 1, $37.40; July 1, $38.00 and on Dec. 1, $40. If bought in car lots it will cost $1.00 per ton less. If sold in small fractions of a ton the price will be considerably higher. Again, if several dealers in one place are competing for trade, the quoted prices are likely to be less than where there is no competition, or where the dealer knows that payments will be slow.

The general range of prices is shown in the following table:

AVERAGE HIGHEST AND LOWEST PRICES QUOTED TO THE STATION AGENT, 1917.

Formula.	Average Cash Ton Price.	Lowest.	Highest.
1– 7–1	$29.00	.....	.....
1– 8–1	29.75	$28.00	$31.00
1–10–1	31.67	30.00	35.00
2– 8–1	33.50	30.00	34.00
2 –9–1	33.33	31.00	36.00
2–10–1	35.10	32.00	38.00
2– 8–3	42.50	.....	.....
2– 8–4	50.00	.....	.....
3– 6–½	37.50	.....	.....
3– 8–½	27.75	25.50	32.00
3– 8–1	36.00	34.00	39.00
3– 9–1	36.23	34.00	41.00
4– 6–2	33.50	.....	.....
4– 8–1	36.75	33.00	40.00
4– 8–4	54.00	.....	.....
4– 9–1	38.19	33.00	44.00
4–10–3	49.50	48.00	51.00
5– 3–1	38.50	.....	.....
5– 4–1	41.50	40.00	42.00
5– 6–1	42.00	.....	.....
5– 4–2	45.75	.....	.....
5– 8–1	43.36	39.00	50.00
5– 8–4	65.00	.....	.....
6– 4–2	52.00	.....	.....
7– 6–1	49.00	.....	.....
10– 5–1	59.00	.....	.....
12– 5–1	66.00	.....	.....

A rough "valuation" may be made by valuing nitrogen as

Nitrates at	26 cents
Ammonia at	29 "
Organic	25 "
Available phosphoric acid at	6½ cents
Water-soluble potash	28½ "

ANALYSES REQUIRING SPECIAL NOTICE.

8910. The American Ag'l. Chem. Co.'s Complete Manure for Top Dressing 1916 was found below guaranty in nitrogen. A second sample, **9345,** taken from a different source, was analyzed with approximately the same results.

8909. The above company's Sure Growth Phosphate being somewhat below guaranty in potash, a second sample, **9344,** of this brand from a different source was found to meet fully its guaranty.

A similar result appears in the two analyses of Bradley's Patent Superphosphate, 1916, Nos. **8977** and **9346.**

9213. Armour Fertilizer Co.'s Bidwell's 3-8-1, having considerably less nitrogen than was guaranteed, the manufacturer requested the analysis of another sample, but it was not possible at that time to find the brand on sale in the State.

9032. Coe-Mortimer Co.'s New Englander Special 1916, being found deficient in both nitrogen and potash, effort was made without success to find for analysis another sample.

9405. National Extra High Grade Potato Fertilizer showed deficiencies in all three ingredients and we were unable to get another sample from a different source for analysis.

9040. The Royster Guano Co.'s Dreadnaught Fertilizer, having been found deficient in potash, a second sample, **9282,** was drawn from a different source, which showed more potash, 1.86 per cent., the guaranty being 2 per cent.

9068. Quinnipiac Wrapper Leaf Brand Tobacco Manure, without Potash, not meeting its nitrogen guaranty, a second sample was analyzed, **9319,** which fully met the guaranty.

8997. Rogers H. G. Soluble Tobacco Manure failing to meet its guaranty of available phosphoric acid, a second sample, **9347,** drawn from a different source, was analyzed but agreed in composition with the first sample. It will be noticed that most of the superphosphates without potash made by this firm, while fully meeting their guaranties in all other respects, fail to meet them in the one particular of "available" phosphoric acid. The manufacturer states that the phosphatic material used is precipitated bone mixed with fine bone sawings; that the amount of available phosphoric acid found in these materials when separately analyzed should yield fully the amount guaranteed in the mixture of them; but that this is not the case and that there are large discrepancies between the analyses of mixtures of these two ingredients reported by different trade chemists. Examination of the bone used shows the presence of a considerable amount of carbonate of lime. The presence of carbonates, we believe, in any fertilizer is likely to reduce the amount of "available" phosphoric acid found by the official method. The precipitated bone, whether alone or mixed with carbonates, is, we believe, readily available to crops.

9225. Royster's Curfew Ammoniated Superphosphate having failed to meet its nitrogen guaranty, a second sample, **9348,** drawn from a different source, was analyzed and substantially met the nitrogen guaranty. The same thing was found in Royster's Good Will Ammoniated Superphosphate, Samples **9228** and **9404.**

8907. In Sanderson's H. G. Ammoniated Phosphate the available phosphoric acid was below guaranty but in two other samples of the same brand, **9075** and **9308,** this guaranty was fully met.

TABLE I—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling	Dealer's cash price per ton.
	Sampled by Station:		
	American Agricultural Chemical Co., New York City.		
*8910	Complete Manure for Top Dressing 1916	Milford	$43 7
*9345	Complete Manure for Top Dressing 1916	Hazardville	43 7
*8909	Sure Growth Phosphate 1916	Hazardville	36 7
*9344	Sure Growth Phosphate 1916	Thompsonville	36 0
9212	Triumph Crop Special	Milford	
9291	Bradley's B. D. Sea Fowl Guano 1916	Middletown	35 0
8978	Bradley's Complete Manure for Potatoes and Vegetables 1916	Norwalk	37 5
9181	Bradley's Corn Phosphate 1916	South Coventry	
9182	Bradley's Half Century Fertilizer 1916	Canaan	35 0
9305	Bradley's New Method Fertilizer 1916	Canaan	31 0
*8977	Bradley's Patent Superphosphate 1916	Suffield	34 0
*9346	Bradley's Patent Superphosphate 1916	Thompsonville	34 0
8976	Bradley's Potato Fertilizer 1916	Groton	35 0
9183	Bradley's Potato Manure 1916	Suffield	36 0
8979	Bradley's Tobacco Manure 1916	Glastonbury	40 2
9047	Bradley's Tobacco Manure (Carb.)	Hartford	
9294	Bradley's Unicorn 1916	Cos Cob	33 0
9185	East India Corn King 1916	Southport	34 0
9187	East India Potato and Garden Manure	Burnside	37 0
9184	East India Roanoke Phosphate 1916	Southport	31 0
9288	East India Tobacco Special 1916	Burnside	39 0
9186	East India Unexcelled Fertilizer 1916	Southport	33 0
9189	Quinnipiac Ammoniated Dissolved Bone 1916	Branford	31 0
9236	Quinnipiac B Fertilizer 1916	Shelton	35 0
9188	Quinnipiac Climax Phosphate 1916	Milford	30 0
9320	Quinnipiac Climax Phosphate 1916	East Haven	
9190	Quinnipiac Fish and Potash Mixture 1916	Windsor	34 0
9191	Quinnipiac Market Garden Manure 1916	Hazardville	37 5
8911	Quinnipiac Potato Phosphate 1916	Branford	32 0
9192	Quinnipiac Wrapper Leaf Brand Tobacco Manure	Hazardville	41 0
9295	Wheeler's Corn Fertilizer 1916	New Milford	32 0
9296	Wheeler's Cuban Tobacco Grower 1916	New Milford	44 0
9297	Wheeler's Potato Manure 1916	New Milford	34 0
9207	Williams and Clark's Americus Corn Phosphate 1916	Milford	
9298	Williams and Clark's Americus H. G. Special for Potatoes and Root Crops, 1916	Southington	39 0
9208	Williams and Clark's Americus Potato Manure	Waterbury	35 0
9237	Williams and Clark's Elk Brand 1916	Waterbury	30 0
9209	Williams and Clark's Meadow Queen Fertilizer 1916	Milford	
9210	Williams and Clark's Seed Leaf Tobacco Manure 1916	Manchester	
9304	Williams and Clark's Special Prolific Crop Producer	Norfolk	30 0
	Apothecaries Hall Co., Waterbury, Conn.		
9286	Victor Tobacco Special	Wapping	42 0

* See page 392.

WITH POTASH.

Nitrogen.						Phosphoric Acid.							Potash.			
				Total					Total.		So-called "Available"					
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
.94	0.98	0.20	1.68	3.80	4.11	6.26	3.52	0.67	10.45	9.0	9.78	8.0	1.01	1.01	1.0	8910
.03	0.99	0.16	1.66	3.84	4.11	5.75	3.48	0.51	9.74	9.0	9.23	8.0	0.90	1.19	1.0	9345
.60	0.84	0.42	0.84	2.70	2.47	6.01	4.02	1.19	11.22	10.0	10.03	9.0	0.65	0.71	1.0	8909
.38	1.07	0.24	1.15	2.84	2.47	6.08	3.91	1.04	11.03	10.0	9.99	9.0	0.40	1.14	1.0	9344
18	0.04	0.48	0.79	2.49	2.47	4.96	3.32	1.37	9.65	9.0	8.28	8.0	2.94	2.94	3.0	9212
.24	0.12	0.09	0.49	0.94	0.82	5.83	4.51	1.20	11.54	11.0	10.34	10.0	0.51	0.85	1.0	9291
.82	0.05	0.73	0.86	3.46	3.29	5.52	3.96	1.97	11.45	10.0	9.48	9.0	1.07	1.07	1.0	8978
.46	0.50	0.32	0.49	1.77	1.65	5.83	4.76	1.13	11.72	11.0	10.59	10.0	1.07	1.07	1.0	9181
.41	0.44	0.49	0.60	1.94	2.06	5.26	5.39	1.75	12.40	11.0	10.65	10.0	1.00	1.00	1.0	9182
.07	0.08	0.56	0.22	0.93	0.82	6.51	2.46	1.09	10.06	9.0	8.97	8.0	0.80	1.02	1.0	9305
.14	0.58	0.34	1.00	2.06	2.06	5.50	4.16	0.87	10.53	9.0	9.66	8.0	0.70	0.76	1.0	8977
.26	0.33	0.27	1.22	2.08	2.06	5.10	4.49	0.90	10.49	9.0	9.59	8.0	0.96	0.96	1.0	9346
.53	0.76	0.61	0.56	2.46	2.06	4.35	5.09	1.36	10.80	9.0	9.44	8.0	0.70	1.01	1.0	8976
.63	0.56	0.29	1.07	2.55	2.47	6.11	4.60	0.79	11.50	10.0	10.71	9.0	1.03	1.03	1.0	9183
.87	0.05	0.09	3.43	4.44	4.53	1.56	2.85	0.43	4.84	4.0	4.41	3.0	0.25	1.10	1.0	8979
.60	0.11	1.12	2.89	4.72	4.53	0.33	3.16	0.28	3.77	4.0	3.49	3.0	0.80	§2.92	3.0	9047
.17	0.88	0.38	0.70	2.13	1.65	7.01	3.55	1.57	12.13	10.0	10.56	9.0	0.40	0.76	1.0	9294
.60	0.55	0.44	0.77	2.36	2.47	6.46	4.17	0.97	11.60	10.00	10.63	9.00	1.01	1.01	1.0	9185
.97	1.04	0.58	0.90	3.49	3.29	5.28	4.17	2.03	11.48	10.0	9.45	9.0	1.06	1.06	1.0	9187
.21	0.20	0.21	0.96	1.58	1.23	6.88	4.12	1.68	12.68	11.0	11.00	10.0	1.00	1.00	1.0	9184
.88	0.08	0.18	3.37	4.51	4.53	2.15	1.56	0.49	4.20	4.0	3.71	3.0	0.11	1.15	1.0	9288
.21	0.50	0.25	0.84	1.80	2.06	5.70	4.02	1.27	10.99	9.0	9.72	8.0	0.66	0.66	1.0	9186
.12	0.15	0.51	0.93	1.71	1.65	1.94	8.64	1.74	12.32	10.0	10.58	9.0	1.26	1.26	1.0	9189
.38	0.12	0.42	0.45	1.37	1.23	6.10	4.64	1.75	12.49	11.0	10.74	10.0	0.91	0.91	1.0	9236
.06	1.16	0.54	0.89	3.65	0.82	6.07	3.75	0.93	10.75	9.0	9.82	8.0	1.07	1.07	1.0	9188
.23	0.17	0.64		1.04	0.82	4.20	4.78	0.97	9.95	9.0	8.98	8.0	0.90	1.02	1.0	9320
.55	0.60	0.57	0.76	2.48	2.47	5.21	4.46	1.56	11.23	10.0	9.67	9.0	0.95	0.95	1.0	9190
.05	1.10	0.48	0.78	3.41	3.29	5.85	3.94	0.96	10.75	10.0	9.79	9.0	1.09	1.09	1.0	9191
.18	0.30	0.54	1.72	2.74	2.06	1.22	7.78	1.80	10.80	9.0	9.00	8.0	1.07	1.07	1.0	8911
.18	0.06	0.08	3.10	4.42	4.53	2.46	1.55	0.63	4.64	4.0	4.01	3.0	0.20	1.04	1.0	9192
.30	0.25	0.26	0.64	1.45	1.65	5.45	4.68	0.96	11.09	11.0	10.13	10.0	1.09	1.09	1.0	9295
.22	0.04	0.26	3.08	4.60	4.53	2.46	1.48	0.50	4.44	4.0	3.94	3.0	0.20	1.00	1.0	9296
.25	0.35	0.48	0.86	2.94	2.06	6.45	4.09	1.01	11.55	11.0	10.54	10.0	0.45	0.45	1.0	9297
.54	0.22	0.57	0.58	1.91	1.65	5.58	4.91	1.73	12.22	11.0	10.49	10.0	1.00	1.00	1.0	9207
.91	0.88	0.63	0.73	3.15	3.29	6.46	3.80	0.86	11.12	10.0	10.26	9.0	0.91	1.01	1.0	9298
.34	0.24	0.24	1.14	1.96	2.06	4.69	4.53	0.95	10.17	9.0	9.22	8.0	0.92	0.92	1.0	9208
.16	0.08	0.17	0.47	0.88	0.82	7.91	5.00	0.88	13.79	11.0	12.91	10.0	1.00	1.00	1.0	9237
.89	0.43	0.47	0.77	2.56	2.47	5.00	4.79	1.65	11.44	10.0	9.79	9.0	0.91	0.91	1.0	9209
.95	0.10	0.00	3.25	4.30	4.53	1.56	1.93	0.35	3.84	4.0	3.49	3.0	0.20	1.09	1.0	9210
.43	0.05	0.19	0.65	1.32	0.82	5.73	3.39	1.59	10.71	9.0	9.12	8.0	0.96	0.96	1.0	9304
.17	1.69	0.52	1.76	4.14	4.11	2.63	1.36	0.51	4.50	5.0	3.99	4.0	1.06	1.06	1.0	9286

§0.83% as sulphate, 1.29% as carbonate.

TABLE I.—NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Armour Fertilizer Works, Chrome, N. J.		
9115	Grain Grower, 2–8–2 Fertilizer	Rockville	$35.00
9116	Special Tobacco Grower No. 1, 5–4–1 Fertilizer	Hazardville	42.00
‡9117	Wheat, Corn, Oats Special, 1–7–1 Fertilizer	Bridgeport	29.00
†*9213	Bidwells 3–8–1	Windsor Locks	34.00
‡8980	1–8–2 Fertilizer	Bridgeport	34.00
8981	2–8–3 Fertilizer	Hazardville	42.50
9214	2½–8–1	Thompsonville	35.00
9215	3–8–1	Norwalk	39.00
9114	4–8–1	Manchester	38.00
†9299	5–8–4 Fertilizer	Orange	65.00
†9290	7–6–1 Fertilizer	New London	48.00
	Bowker Fertilizer Co., New York City.		
8982	All Round Fertilizer 1916	Meriden	34.00
9241	Ammoniated Food for Flowers	Waterbury	*
†9240	Complete	Milldale	51.00
9239	Corn Phosphate 1916	West Stafford	38.00
8912	Farm and Garden Phosphate 1916	New Haven	36.00
8983	Stockbridge General Crop Manure 1916	Yalesville	44.00
9217	Hill and Drill Phosphate 1916	Yalesville	41.00
9242	Lawn and Garden Dressing 1916	New Haven	50.00
9238	Stockbridge Early Crop Manure 1916	West Stafford	43.00
9216	Sure Crop Phosphate 1916	Waterbury	.....
	E. D. Chittenden Co., Bridgeport, Conn.		
9243	Complete Tobacco and Onion Grower, 2% Potash	Broad Brook	..
9244	Connecticut Tobacco Grower	Broad Brook	.....
9302	Connecticut Tobacco Grower	Suffield	52.00
9245	Tobacco Special, 2% Potash	Suffield	50.00
	Coe-Mortimer Co., New York City.		
9246	Columbian Corn and Potato Fertilizer 1916	Milford	30.00
9247	Gold Brand Excelsior Guano 1916	Washington Depot	35.00
9292	H. G. Potato Fertilizer Revised	Greenwich	48.00
§9032	New Englander Special 1916	Brooklyn	28.00
†9293	Red Brand Excelsior Guano 1916	Greenwich	48.00
9254	Standard Potato Fertilizer 1916	Wethersfield	31.35
	T. H. Eldredge, Norwich, Conn.		
8913	Fish and Potash	Norwich	32.00
	International Agricultural Corporation, Buffalo, N. Y.		
9258	Buffalo Economy	West Suffield	34.50
9255	Buffalo General Favorite	East Granby	.

* See page 392. † See page 387. ‡ See page 390. § See page 393.

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available"					
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
.13	0.28	0.34	1.01	1.76	1.65	2.78	5.36	1.28	9.42	8.5	8.14	8.0	1.96	1.96	2.0	9115
.18	0.10	0.77	3.16	4.21	4.11	3.12	1.64	0.72	5.48	4.5	4.76	4.0	0.20	1.07	1.0	9116
.03	0.08	0.25	0.56	0.92	0.82	4.54	2.82	0.81	8.17	7.5	7.36	7.0	0.70	1.02	1.0	9117
.17	0.55	0.51	0.95	2.18	2.47	4.48	3.26	1.16	8.90	8.5	7.74	8.0	0.20	1.00	1.0	9213
.05	0.05	0.25	0.55	0.90	0.82	4.52	3.79	0.86	9.17	8.5	8.31	8.0	1.14	2.04	2.0	8980
.19	0.24	0.40	0.90	1.73	1.65	3.45	4.48	1.18	9.11	8.5	7.93	8.0	3.04	3.04	3.0	8981
.26	0.16	0.26	1.48	2.16	2.06	4.46	3.52	1.32	9.30	8.5	7.98	8.0	1.00	1.00	1.0	9214
.24	0.21	0.99	1.28	2.72	2.47	4.02	3.54	1.69	9.25	8.5	7.56	8.0	0.51	1.04	1.0	9215
.63	0.22	0.47	2.02	3.34	3.29	5.04	3.11	0.75	8.90	8.5	8.15	8.0	1.07	1.07	1.0	9114
.20	0.12	0.56	1.88	3.76	4.11	4.61	2.84	0.87	8.32	8.5	7.45	8.0	3.64	3.64	4.0	9299
.55	0.57	0.43	2.37	4.92	5.76	4.30	1.94	0.64	6.88	6.5	6.24	6.0	1.07	1.07	1.0	9290
.16	0.90	0.54	0.85	2.45	2.06	6.57	3.54	1.84	11.95	11.0	10.11	10.0	0.85	1.01	1.0	8982
.68	0.03	0.19		2.90	2.47	0.41	5.93	1.50	7.84	7.0	6.34	6.0	2.11	2.79	2.0	9241
.10	1.18	0.34	0.98	2.60	3.29	6.92	3.05	0.96	10.93	11.0	9.97	10.0	2.02	2.02	3.0	9240
.50	0.38	0.54	0.34	1.76	1.65	6.30	4.52	1.45	12.27	11.0	10.82	10.0	0.75	0.98	1.0	9239
...	0.48	0.38	1.08	1.94	1.65	6.56	4.09	0.95	11.60	11.0	10.65	10.0	1.17	1.17	1.0	8912
...	1.72	0.62	0.94	3.28	3.29	7.78	2.57	0.95	11.30	10.0	10.35	9.0	0.87	0.87	1.0	8983
.19	0.95	0.33	1.01	2.48	2.47	6.44	3.52	0.97	10.93	10.0	9.96	9.0	1.13	1.13	1.0	9217
.32	0.05	0.25	1.02	4.64	4.11	5.11	3.34	0.35	8.80	9.0	8.45	8.0	1.00	1.00	1.0	9242
.32	1.43	1.11	0.32	4.18	4.11	4.07	4.07	1.42	9.56	9.0	8.14	8.0	1.11	1.11	1.0	9238
.18	0.20	0.18	0.48	1.04	0.82	5.26	5.33	1.00	11.59	11.0	10.59	10.0	0.71	1.00	1.0	9216
.16	1.90	0.15	1.09	3.30	3.29	7.80	1.63	0.65	10.08	9.0	9.43	8.0	1.11	1.99	2.0	9243
12	2.94	0.31	1.38	4.75	4.95	3.75	1.14	0.38	5.27	5.0	4.89	4.0	0.20	2.07	2.0	9244
18	3.02	0.13	1.62	4.95	4.94	3.83	0.89	0.32	5.04	5.0	4.72	4.0	0.20	1.94	2.0	9302
11	2.56	0.20	1.65	4.52	4.50	3.43	0.70	0.27	4.40	4.0	4.13	3.0	0.15	2.02	2.0	9245
24	0.28	0.48	0.50	1.50	1.23	6.12	4.60	1.61	12.33	11.0	10.72	10.0	1.02	1.02	1.0	9246
91	0.44	0.50	0.69	2.54	2.47	5.85	4.41	1.43	11.69	10.0	10.26	9.0	0.80	0.97	1.0	9247
27	1.65	0.20	1.07	3.19	3.29	7.77	2.88	0.42	11.07	11.0	10.65	10.0	3.01	3.01	3.0	9292
43	0.62	0.48	0.42	1.95	0.82	4.83	5.00	1.30	11.13	9.0	9.83	8.0	0.20	0.55	1.0	9032
91	1.12	0.37	1.18	3.58	4.11	4.63	3.44	0.92	8.99	9.0	8.07	8.0	0.88	0.88	1.0	9293
12	1.20	0.34	0.71	3.37	3.29	4.70	4.32	1.04	10.06	10.0	9.02	9.0	0.86	0.86	1.0	9254
92	0.28	0.30	1.34	2.84	2.40	7.09	2.57	2.01	11.67	9.0	9.66	8.0	0.31	0.41	0.5	8913
73	0.05	0.26	0.64	1.68	1.60	5.58	4.51	1.60	11.69	11.0	10.09	10.0	1.07	1.07	1.0	9258
66	0.18	0.08	0.53	1.45	0.80	3.80	4.25	1.46	9.51	9.0	8.05	8.0	1.07	1.07	1.0	9255

TABLE I—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station;		
	International Agricultural Corp., Buffalo, N. Y. (*Con.*)		
9257	Buffalo High Grade Manure	Stafford Springs	$33.00
9256	Buffalo Potash Special	West Cheshire	35.75
8984	Buffalo Potato and Corn	Waterbury	50.00
	Kirke Chemical Co., Brooklyn, N. Y.		
8985	Kirke Fertilizer	Greenwich	§
	Lister's Agricultural Chemical Works, Newark, N. J.		
9300	Ammoniated Dissolved Superphosphate 1916	Branford	32.00
9262	Complete Tobacco Manure 1916	West Suffield	40.00
8986	Corn and Potato Fertilizer 1916	West Suffield	31.00
9263	Potato Manure 1916	Burnside	42.00
9260	Special Tobacco Fertilizer 1916	Brookfield	33.00
9261	Standard Pure Superphosphate of Lime 1916	Burnside	35.00
9259	Success Fertilizer 1916	East Canaan	29.00
	Lowell Fertilizer Co., Boston, Mass.		
9264	Superior Fertilizer	Wethersfield	37.05
	E. Manchester and Sons, Winsted, Conn.		
9265	1917 Special	Ellington	39.00
	The Mapes Formula and Peruvian Guano Co., New York City.		
8987	Corn Manure 1916 Brand	Middletown	36.00
9033	General Special 1916 Brand	Windsor Locks	50.00
9034	Potato Manure 1916 Brand	Suffield	41.00
9403	Tobacco Manure 1916 Brand	Hartford	59.00
8914	Tobacco Starter Improved	Windsor Locks	42.00
9119	Top Dresser Half Strength 1916 Brand	Hartford	42.00
9118	Top Dresser Full Strength 1916 Brand	Hartford	66.00
	National Fertilizer Co., New York City.		
8915	Complete Root and Grain Fertilizer 1916	Thompsonville	39.50
9121	Eureka Potato Fertilizer 1916	So. Manchester	38.25
9037	Extra H. G. Manure 1916	Warehouse Point	41.75
†*9405	Extra H. G. Potato Fertilizer	West Cheshire	54.00
9036	Potato Phosphate 1916	Guilford	[illegible]
8916	Tobacco Special 1916	Warehouse Point	39.[illegible]
9035	Universal Phosphate 1916	Wallingford	30.00
9120	XXX Fish and Potash 1916	Wallingford	30.00
	Olds and Whipple, Hartford, Conn.		
9038	Complete Corn, Potato and Onion Fertilizer	Silver Lane	33.50
9268	Complete Tobacco Fertilizer	Hartford	42.50

*See page 393. †See page 387. § 30 cts. per package.

WITH POTASH—(*Continued.*)

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available"					
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
.06	0.19	0.79	0.58	3.62	3.30	2.66	6.63	2.57	11.86	9.0	9.29	8.0	2.03	2.03	1.0	9257
.19	0.05	0.28	0.50	1.02	0.80	3.24	5.32	1.71	10.27	9.0	8.56	8.0	1.90	1.90	3.0	9256
.61	0.21	0.40	0.48	1.70	1.60	2.04	6.54	0.82	9.40	9.0	8.58	8.0	3.90	3.90	4.0	8984
.03	0.02	0.14	0.07	5.26	5.00	8.28	1.97	0.46	10.71	8.3	10.25	7.5	3.05	3.05	3.15	8985
.77	0.14	0.55	0.59	2.05	2.06	3.52	4.31	2.39	10.22	9.0	7.83	8.0	0.31	0.93	1.0	9300
.38	0.10	0.39	1.97	3.84	4.11	2.32	2.72	1.42	6.46	5.0	5.04	4.0	0.31	0.97	1.0	9262
.71	0.22	0.63	0.69	2.25	2.06	1.57	6.13	2.65	10.35	9.0	7.70	8.0	1.03	1.03	1.0	8986
.74	1.28	1.53	0.72	4.27	4.11	4.24	4.11	1.82	10.17	9.0	8.35	8.0	0.23	1.08	1.0	9263
.86	0.08	0.60	0.68	2.22	2.06	4.46	5.49	2.65	12.60	11.0	9.95	10.0	0.47	1.36	1.0	9260
.60	0.34	0.79	0.90	2.63	2.47	4.69	4.23	2.57	11.49	10.0	8.92	9.0	1.02	1.02	1.0	9261
.14	0.25	0.33	0.67	1.39	1.23	5.26	6.06	0.86	12.18	11.0	11.32	10.0	0.87	0.87	1.0	9259
.51	1.79	0.55	0.68	3.53	3.69	6.24	3.01	0.50	9.75	10.0	9.25	9.0	1.14	1.14	1.0	9264
.07	0.23	0.65	1.42	4.37	4.11	2.38	5.76	2.03	10.17	.....	8.14	8.0	0.68	0.93	1.0	9265
.92	0.01	0.13	0.62	2.68	2.47	3.17	4.63	2.93	10.73	10.0	7.80	8.0	0.51	1.34	1.0	8987
.54	0.02	0.07	1.13	5.76	5.76	2.07	4.74	2.81	9.62	8.0	6.81	6.0	0.60	1.20	1.0	9033
.52	0.06	0.04	0.40	4.02	3.71	5.31	3.61	1.37	10.29	8.0	8.92	8.0	0.45	0.92	1.0	9034
.69	0.11	0.83	2.59	8.22	8.23	0.16	5.34	2.70	8.20	8.0	5.50	5.0	0.80	1.53	1.0	9403
.10	0.02	0.21	1.25	4.58	4.12	2.21	4.50	2.64	9.35	8.0	6.71	6.0	0.33	0.96	1.0	8914
.76	0.05	0.00	0.20	5.01	4.94	0.63	2.15	1.45	4.23	4.0	2.78	2.5	0.51	1.31	0.5	9119
.20	0.04	0.19	0.59	10.02	9.88	0.94	5.23	1.97	8.14	8.0	6.17	5.0	1.31	2.00	1.0	9118
.05	1.05	0.52	1.02	3.64	3.29	5.73	4.09	0.87	10.69	10.0	9.82	9.0	1.00	1.00	1.0	8915
.45	0.66	0.56	0.94	2.61	2.47	6.11	4.15	0.88	11.14	10.0	10.26	9.0	0.86	0.99	1.0	9121
.26	1.39	0.84	0.61	4.10	4.11	5.53	3.65	0.95	10.13	9.0	9.18	8.0	0.97	0.97	1.0	9037
.08	1.02	0.37	1.51	3.98	4.11	5.78	3.98	0.74	10.50	11.0	9.76	10.0	2.62	2.62	4.0	9405
.16	0.61	0.27	0.87	1.91	2.06	4.67	4.56	1.16	10.39	9.0	9.23	8.0	1.02	1.02	1.0	9036
.12	0.08	0.27	3.12	4.59	4.53	1.46	2.53	0.40	4.39	4.0	3.99	3.0	0.20	1.21	1.0	8916
.26	0.18	0.21	0.39	1.04	0.82	6.11	5.31	0.91	12.33	11.0	11.42	10.0	0.71	0.93	1.0	9035
.46	0.25	0.38	1.10	2.19	2.06	6.30	4.50	1.52	12.32	11.0	10.80	10.0	1.03	1.03	1.0	9120
.18	0.07	0.55	1.85	3.65	3.30	0.31	6.54	1.07	7.92	6.0	6.85	6.0	1.13	2.09	2.0	9038
.04	0.10	0.23	3.39	4.76	4.50	1.19	2.33	0.37	3.89	3.0	3.52	3.0	0.11	1.49	1.0	9268

TABLE I—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Olds & Whipple, Hartford, Conn. (*Continued.*)		
9049	Complete Tobacco Fertilizer	Hartford	.....
9050	Complete Tobacco Fertilizer	Hartford	.....
9051	Complete Tobacco Fertilizer	Hartford	.....
9269	Fish and Potash	Ellington	$37.50
	Rogers and Hubbard Co., Portland, Conn.		
†9039	Hubbard's Bone Base Soluble Potato Manure	Branford	50.00
9271	Hubbard's Tobacco Special	Portland	.....
9272	Rogers' H. G. Soluble Tobacco and Potato Manure	Somers	47.00
9273	Rogers' H. G. Tobacco Grower (Vegetable Formula)	Granby	41.00
	F. S. Royster Guano Co., Baltimore, Md.		
9289	Arrow Head Tobacco Fertilizer	Hockanum	45.25
*9040	Dreadnaught Fertilizer	Madison	36.00
*‡9282	Dreadnaught Fertilizer	New Britain	42.00
9274	Drillwell Phosphate	Madison	35.00
‡8918	Logical Compound	West Suffield	.....
8917	Pipe of Peace Tobacco Fertilizer	Glastonbury	38.50
8919	Sensation Fertilizer	Plainville	40.00
9275	Trucker's Delight	Madison	54.00
9041	True Blue Compound	Windsor	.....
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
9043	Atlantic Coast Bone, Fish and Potash 1916	Plainville	36.00
8908	Complete Tobacco Grower 1916	Glastonbury	41.00
9277	Corn Superphosphate 1916	East Hampton	33.00
9042	Formula A	Guilford	38.00
9276	Formula B	Bloomfield	.....
9283	Kelsey's Bone, Fish and Potash 1916	Branford	33.25
9278	Potato Manure	Stafford Springs	35.00
9301	Top Dressing for Grass and Grain 1916	East Hartford	.....
	Virginia-Carolina Chemical Co., New York City.		
9056	Indian Brand for Tobacco No. 1	Hazardville	.....
9057	Indian Brand for Tobacco No. 1	Southwick, Mass	.....
9058	Indian Brand for Tobacco No. 1	Windsor Locks	.....
9059	Indian Brand for Tobacco No. 1	Weatogue	.....
9284	Indian Brand for Tobacco No. 2 (Sulph.)	Hazardville	42.00
9285	Owl Brand Potato and Truck Fertilizer with 1% Potash	Shelton	34.00
8920	XXXX Fish and Potash Mixture	Bristol	33.00
	Wilcox Fertilizer Co., Mystic, Conn.		
8887	Fish and Potash	Meriden	25.50
9124	H. G. Vegetable Fertilizer	Ellington	39.00

* See page 393. † See page 387. ‡ See page 390.

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.71	0.09	0.54	3.58	4.92	4.50	0.66	2.75	0.42	3.83	3.0	3.41	3.0	0.31	2.45	2.0	9049
0.49	0.06	0.96	3.42	4.93	4.50	0.81	2.75	0.43	3.99	3.0	3.56	3.0	0.31	2.31	2.0	9050
....	....	....	....	4.60	4.50	....	....	....	3.88	3.0	.....	3.0	0.31	2.36	2.0	9051
0.55	0.12	0.49	1.72	2.88	2.45	0.56	5.98	2.11	8.65	6.0	6.54	6.0	1.75	2.62	2.0	9269
0.63	0.95	0.82	0.96	4.36	4.25	0.11	8.27	4.72	13.10	12.0	8.38	10.0	0.20	0.93	1.0	9039
0.79	0.13	0.37	3.06	5.35	5.00	0.34	3.94	0.50	4.78	5.0	4.28	4.0	0.20	0.88	0.5	9271
0.64	1.19	0.54	0.94	4.31	4.25	0.09	8.27	4.94	13.30	12.0	8.36	10.0	0.20	1.02	1.0	9272
0.41	0.09	0.12	3.53	5.15	5.00	0.30	3.97	1.51	5.78	5.0	4.27	4.0	0.11	0.93	0.5	9273
0.24	0.71	0.19	2.80	3.94	4.11	2.15	2.02	0.82	4.99	4.5	4.17	4.0	0.20	1.96	2.0	9289
0.13	0.79	0.40	0.70	2.02	1.65	5.15	3.34	0.72	9.21	8.5	8.49	8.0	0.40	1.62	2.0	9040
0.69	0.27	0.33	0.45	1.74	1.65	5.47	2.62	1.20	9.29	8.5	8.09	8.0	0.25	1.86	2.0	9282
0.21	1.17	0.46	0.96	2.80	2.47	5.37	2.99	0.67	9.03	8.5	8.36	8.0	0.20	0.84	1.0	9274
....	0.55	0.60	0.79	1.94	1.65	5.45	2.69	0.65	8.79	8.5	8.14	8.0	0.20	0.97	1.0	8918
0.17	0.83	0.33	2.61	3.94	4.11	1.58	1.36	0.19	3.13	3.5	2.94	3.0	0.25	1.03	1.0	8917
0.48	0.72	0.58	1.63	3.41	3.29	6.22	2.25	0.70	9.17	8.5	8.47	8.0	0.40	1.07	1.0	8919
0.18	1.37	0.82	1.18	3.55	3.29	4.17	4.14	0.86	9.17	8.5	8.31	8.0	0.55	3.64	4.0	9275
0.12	1.28	0.71	1.27	3.38	3.29	4.97	4.10	0.60	9.67	8.5	9.07	8.0	0.60	2.71	3.0	9041
0.20	0.30	0.38	0.97	1.85	1.65	1.13	8.36	2.96	12.45	10.0	9.49	9.0	0.90	0.90	1.0	9043
0.00	0.14	0.06	3.31	4.51	4.53	0.61	3.03	0.49	4.13	4.0	3.64	3.0	0.31	1.04	1.0	8908
0.31	0.21	0.49	1.38	2.39	1.65	5.30	4.54	1.71	11.55	11.0	9.84	10.0	0.85	1.06	1.0	9277
0.50	0.61	0.71	1.49	3.31	3.29	6.76	3.73	3.13	13.62	10.0	10.49	9.0	0.90	1.13	1.0	9042
0.51	0.11	0.53	1.27	3.42	3.29	4.50	5.25	3.66	13.41	10.0	9.75	9.0	0.31	0.95	1.0	9276
0.93	0.06	0.56	1.16	2.71	2.47	4.89	5.67	0.79	11.35	10.0	10.56	9.0	0.20	0.87	1.0	9283
0.20	0.12	0.72	1.56	2.60	2.06	1.77	7.18	1.83	10.78	9.0	8.95	8.0	1.21	1.21	1.0	9278
0.20	0.06	0.54	1.45	4.25	4.11	3.69	4.85	1.50	10.04	9.0	8.54	8.0	1.66	1.66	1.0	9301
0.25	2.24	0.21	1.96	4.66	4.11	3.84	1.19	0.55	5.58	5.0	5.03	4.0	0.20	1.93	2.0	9056
....	....	....	....	4.48	4.11	....	....	....	5.54	5.0	.....	4.0	0.20	1.98	2.0	9057
....	....	....	....	4.48	4.11	....	....	....	5.80	5.0	.....	4.0	0.20	1.96	2.0	9058
....	....	....	....	4.39	4.11	....	....	....	6.14	5.0	.....	4.0	0.20	1.95	2.0	9059
0.19	1.87	0.50	2.02	4.58	4.11	3.25	1.60	0.70	5.55	5.0	4.85	4.0	1.00	1.00	1.0	9284
0.14	0.68	0.16	0.77	1.75	1.65	5.94	2.62	1.27	9.83	9.0	8.56	8.0	1.05	1.05	1.0	9285
....	0.68	0.41	0.81	1.90	1.65	6.55	2.71	1.50	10.76	9.0	9.26	8.0	0.94	0.94	1.0	8920
0.66	0.26	1.96		2.88	2.40	6.73	2.44	1.89	11.06	9.0	9.17	8.0	0.31	0.39	0.5	8887
0.94	0.08	1.44	1.62	4.08	4.12	6.12	2.81	0.54	9.47	9.0	8.93	8.0	0.76	0.76	1.0	9124

TABLE I.—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Wilcox Fertilizer Co., Mystic, Conn. (*Continued.*)		
9303	Potato Fertilizer	Suffield	$33.00
9122	Potato, Onion and Vegetable Phosphate	Guilford	36.00
9123	Tobacco Special	Ellington	40.00
	S. D. Woodruff & Sons, Orange, Conn.		
9125	Home Mixture	Orange	36.00
	Sampled by Purchasers and Others:		
8703	Quinnipiac Wrapper Leaf Brand	*Hartford;*—L. B. Haas and Co.	37.50
8704	Quinnipiac Wrapper Leaf Brand	*Hartford;*—L. B. Haas and Co.	37.50
8705	Quinnipiac Wrapper Leaf Brand	*Hartford;*—L. B. Haas and Co.	37.50
8833	Rogers' H. G. Tobacco Grower Vegetable Formula.	*West Suffield;*—H. C. Nelson	.....
8834	Rogers' H. G. Tobacco Grower Vegetable Formula.	*West Suffield:*—H. C. Nelson	.....
8961	Sanderson's Fish, Bone and Potash	*West Cheshire:*—Whitcomb & Hadley	29.75
9396	Sanderson's Kelsey's Bone, Fish and Potash	*Branford:*—A. E. Plant Sons' Co.	.....
8812	Unknown brand	*Brookfield Center:*—E. A. Talmadge	.....
9399	Unknown brand	*S. Windsor:*—W. N. Jennings	.....

WITH POTASH—(*Concluded.*)

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
14	0.22	0.28	1.30	2.94	2.46	6.04	2.70	3.59	12.33	7.0	8.74	6.0	0.31	0.41	0.5	9303
01	0.10	0.48	1.43	4.02	3.72	4.62	3.89	2.01	10.52	9.0	8.51	8.0	0.40	0.63	0.5	9122
29	0.07	0.05	3.78	5.19	4.95	0.36	5.17	0.51	6.04	6.0	5.53	5.0	0.15	1.10	0.5	9123
76	0.10	1.27	1.50	3.63	3.30	5.45	2.99	0.78	9.22	.....	8.44	8.0	0.62	0.62	1.0	9125
..	....	....	....	4.60	4.53	.....	.....	....	4.09	4.0	.....	3.0	.....	0.97	1.0	8730
..	....	....	....	4.59	4.53	.....	.....	....	4.20	4.0	.....	3.0	.....	0.97	1.0	8704
..	....	....	....	4.55	4.53	.....	.....	....	4.41	4.0	.....	3.0	.....	0.92	1.0	8705
..	....	....	....	5.14	5.00	.....	.....	....	5.31	5.0	.....	4.0	0.23	1.07	0.5	8833
..	....	....	....	5.21	5.00	.....	.....	....	5.31	5.0	.....	4.0	0.23	1.06	0.5	8834
..	....	....	....	2.10	....	.....	.....	....	12.26	.....	.....	....	0.89	0.89	....	8961
..	....	....	....	2.58	2.47	.....	.....	....	11.60	10.0	.....	9.0	.....	1.03	1.00	9396
..	....	....	....	3.52	....	.....	.....	....	8.12	.....	.....	....	.....	5.14	....	8812
.	....	....	....	3.90	....	3.48	3.92	1.61	9.01	.....	7.40	....	0.39	0.39	....	9399

TABLE II—NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station Agent: **American Agricultural Chemical Co., New York City.**		
8964	Ammoniated Fertilizer A	Plantsville	$25.00
9000	Ammoniated Fertilizer AA	East Hampton	29.00
8965	Ammoniated Fertilizer AAA	East Hampton	32.00
8966	Ammoniated Fertilizer AAAA	Milford	35.75
9307	Cereal and Root Fertilizer	Rockville	.....
†9306	High Grade Grass Top Dressing without Potash	Rockville	.....
9001	Odorless Grass and Lawn Top Dressing without Potash	Stafford Springs	42.00
9006	Special Vegetable Fertilizer	New London	40.00
9002	Bradley's General Fertilizer	Putnam	30.00
9064	Bradley's Grain Fertilizer	Norwich	23.00
9067	Bradley's Grass Top Dressing without Potash	Norwich	42.00
9003	Bradley's Root Crop Manure	Black Hall	35.00
8927	Bradley's Special Corn Phosphate without Potash	Norwich	28.00
9076	Bradley's Special Potato Phosphate without Potash.	Groton	30.00
8928	Bradley's Special Potato Manure without Potash	Black Hall	34.00
9066	Bradley's Tobacco Manure without Potash	Hazardville	39.50
9065	Bradley's Universal Crop Phosphate	Ellington	.....
9126	East India Tobacco Special without Potash	Burnside	35.50
9004	Quinnipiac Special Corn Manure without Potash	New London	31.00
9005	Quinnipiac Special Potato Phosphate without Potash	Plainfield	28.00
*9068	Quinnipiac Wrapper Leaf Brand Tobacco Manure without Potash	Windsor	35.75
*9319	Quinnipiac Wrapper Leaf Brand Tobacco Manure without Potash	Windsor	35.75
9078	Williams and Clark's Seed Leaf Tobacco Manure without Potash	South Manchester	36.00
9069	Williams and Clark's Special Americus Corn Phosphate without Potash	Ellington	29.00
9077	Williams and Clark's Special Americus Potato Manure without Potash	Ellington	29.00
	Apothecaries Hall Co., Waterbury, Conn.		
9070	Victor Corn, Fruit and All Crops	Windsorville	32.00
9079	Victor Market Gardeners Special	Windsorville	40.00
9071	Victor Potato and Vegetable Special	Windsorville	36.00
8988	Victor Tobacco Special (C. S. M.)	Waterbury	38.00
9080	Victor Top Dresser for Grass and Grain	Windsorville	40.00
	Armour's Fertilizer Works, Chrome, N. J.		
9169	3–10–0	Hazardville	32.25
8899	4–8–0	Hazardville	35.25
9315	5–10–0	New Canaan	40.00
9090	Special Tobacco Grower No. 2	Manchester	38.00
	Atlantic Packing Co., New Haven, Conn.		
9088	Atlantic Corn and Grain Fertilizer	New Haven	28.00
9089	Atlantic Potato Phosphate	New Haven	32.00
8898	Atlantic Special Vegetable	Groton	38.00
†9316	Atlantic Tobacco Special	South Windsor	37.00
8897	Atlantic Top Dresser for Grass and Market Garden.	Groton	40.00

† See page 387. * See page 393.

WITHOUT POTASH.

Nitrogen.						Phosphoric Acid.							
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.16	0.14	0.33	0.49	1.12	0.82	6.16	4.49	1.29	11.94	11.0	10.65	10.0	8964
0.12	0.25	0.90	0.71	1.98	1.65	5.55	4.46	1.96	11.97	11.0	10.01	10.0	9000
0.85	0.50	0.69	0.67	2.71	2.47	5.65	4.33	1.88	11.86	11.0	9.98	10.0	8965
0.90	1.36	0.57	0.61	3.44	3.29	6.84	3.79	1.23	11.86	11.0	10.63	10.0	8966
0.59	1.02	0.47	0.61	2.69	2.47	7.09	3.85	2.07	13.01	11.0	10.94	10.0	9307
3.15	1.62	0.52	0.79	6.08	6.58	5.92	2.83	0.92	9.67	9.0	8.75	8.0	9306
2.24	1.71	0.36	0.59	4.90	4.11	7.65	2.87	0.87	11.39	11.0	10.52	10.0	9001
1.27	1.13	0.51	0.60	3.51	3.29	6.00	3.99	1.75	11.74	11.0	9.99	10.0	9006
0.52	0.46	0.48	0.38	1.84	1.65	5.71	4.00	1.87	11.58	11.0	9.71	10.0	9002
0.44	0.35	0.10	0.23	1.12	0.82	5.64	4.73	0.56	10.93	11.0	10.37	10.0	9064
2.61	1.45	0.38	0.58	5.02	4.94	5.46	3.34	0.73	9.53	9.0	8.80	8.0	9067
1.14	0.08	1.65	0.51	3.38	3.29	6.36	3.71	1.79	11.86	11.0	10.07	10.0	9003
0.62	0.52	0.26	0.35	1.75	1.65	6.00	4.39	0.97	11.36	11.0	10.39	10.0	8927
0.63	0.50	0.31	0.36	1.80	1.65	6.42	4.69	0.88	11.99	11.0	11.11	10.0	9076
1.00	0.82	0.41	0.55	2.78	2.47	6.20	4.10	1.60	11.90	11.0	10.30	10.0	8928
1.06	0.10	0.37	3.13	4.66	4.53	1.20	2.61	0.37	4.18	4.0	3.81	3.0	9066
1.00	0.81	0.36	0.49	2.66	2.47	6.36	3.98	1.24	11.58	11.0	10.34	10.0	9065
0.26	0.06	0.98	3.27	4.57	4.53	1.58	2.15	0.52	4.25	4.0	3.73	3.0	9126
0.38	0.47	0.72	0.09	1.66	1.65	6.13	4.20	1.04	11.37	11.0	10.33	10.0	9004
0.60	0.57	0.30	0.55	2.02	1.65	6.38	3.77	1.65	11.80	11.0	10.15	10.0	9005
0.82	0.08	0.22	3.27	4.39	4.53	2.39	1.53	0.46	4.38	4.0	3.92	3.0	9068
0.87	0.10	3.58		4.55	4.53	2.17	1.58	0.47	4.22	4.0	3.75	3.0	9319
0.85	0.10	0.27	3.12	4.34	4.53	1.62	2.37	0.33	4.32	4.0	3.99	3.0	9078
0.73	0.41	0.37	0.34	1.85	1.65	6.14	4.26	1.33	11.73	11.0	10.40	10.0	9069
0.68	0.40	0.38	0.35	1.81	1.65	6.58	4.37	1.28	12.23	11.0	10.95	10.0	9077
0.38	0.18	0.46	0.83	1.85	1.65	8.30	2.74	2.20	13.24	11.0	11.04	10.0	9070
0.10	1.71	0.51	1.22	3.54	3.29	8.03	2.29	0.87	11.19	11.0	10.32	10.0	9079
0.98	0.48	0.51	0.60	2.57	2.47	8.34	2.28	2.16	12.78	11.0	10.62	10.0	9071
...	1.70	0.60	2.00	4.30	4.11	3.06	1.78	0.70	5.54	5.0	4.84	4.0	8988
0.55	1.95	0.48	1.69	5.67	5.75	3.67	2.55	0.87	7.09	6.0	6.22	5.0	9080
0.13	0.43	0.31	1.71	2.58	2.47	7.29	2.79	1.27	11.35	10.5	10.08	10.0	9169
...	1.31	0.58	1.27	3.16	3.29	6.07	2.00	1.27	9.34	8.5	8.07	8.0	8899
0.20	0.04	0.22	1.63	4.09	4.11	7.46	2.89	0.60	10.95	10.5	10.35	10.0	9315
0.97	0.11	0.06	3.12	4.26	4.11	2.79	1.61	0.81	5.21	4.5	4.40	4.0	9090
0.08	0.07	0.76	0.87	1.78	1.64	6.87	3.62	0.87	11.36	11.0	10.49	10.0	9088
0.24	0.74	0.72	0.86	2.56	2.46	7.28	3.24	0.47	10.99	11.0	10.52	10.0	9089
0.39	1.35	0.78	0.94	3.46	3.28	7.54	3.52	0.77	11.83	11.0	11.06	10.0	8898
0.84	0.08	1.03	1.76	3.71	4.10	2.98	3.80	1.69	8.47	7.0	6.78	6.0	9316
0.88	1.40	0.76	1.26	4.30	4.10	7.09	3.20	0.84	11.13	11.0	10.29	10.0	8897

TABLE II—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton
	Sampled by Station Agent:		
	Berkshire Fertilizer Co., Bridgeport, Conn.		
8900	Ammoniated Bone Phosphate	Norwich Town	$24 00
9081	Economical Grass Fertilizer	Rockville	50 00
9008	Grass Special	Centerbrook	42 00
9091	Market Garden Fertilizer	Westport	48 00
9007	Potato and Vegetable Phosphate	Westport	38 00
8929	Root Fertilizer	Waterbury	36 00
9082	Tobacco Grower	Rockville	36 00
	F. E. Boardman, Middletown, Conn.		
9092	Fertilizer for Potatoes and General Crops	Middletown	34 00
9093	Tobacco Fertilizer	Middletown	35 00
	Bowker Fertilizer Co., New York City.		
9127	Four Ten Hill and Drill	Willimantic	33 00
9010	High Nitrogen Mixture without Potash	Bristol	54 00
9009	One Ten Sure Crop	Mansfield Depot	27 00
8903	Stockbridge Five Eight General Crop	Rockville	38 00
8930	Stockbridge Five Ten Early Crop	Rockville	39 00
8902	Superphosphate with Ammonia 2%	Stratford	....
9083	Superphosphate with Ammonia 3%	Westport	31 00
8901	Superphosphate with Ammonia4%	Stratford	35 00
9084	Superphosphate with Ammonia 5%	Wapping	36 50
9094	Three Ten All Round	Rockville	33 00
8931	Tobacco Grower 1916	Hazardville	38 00
9011	Two Ten Corn	Norwich	30 00
9085	Two Ten Potato	Brooklyn	29 00
	F. O. Brown, Leonard's Bridge, Conn.		
8967	Special Formula for Potatoes and General Crops	Guilford	34 00
8932	Special for Oats and Top Dressing	Guilford	40 50
	E. D. Chittenden Co., Bridgeport, Conn.		
8989	Vegetable and Onion Grower without Potash	Greens Farms	29 00
	E. B. Clark Seed Co., Milford, Conn.		
8904	Ammoniated Bone Phosphate	Stratford	30 50
	The Coe-Mortimer Co., New York City.		
9086	Connecticut Wrapper Grower without Potash	Somersville	40 00
9287	Excelsior Potato Fertilizer 1916	Manchester	..
9095	H. G. Ammoniated Superphosphate 1916	Norwich	34 00
9096	Morcoe Top Dresser without Potash	Somersville	55 00
9072	Prolific Crop Producer 1916	Wethersfield	..
8990	XXV Ammoniated Phosphate 1916	Old Mystic	27 00
	Essex Fertilizer Co., Boston, Mass.		
9170	Potato, Corn and Vegetable Fertilizer	Willimantic	37 00
§9097	Potato Manure	Ellington	40 00
9074	Potato Phosphate	South Manchester	38 00
9098	Tobacco Manure	South Manchester	41 00
9073	XXX Fish Fertilizer	Poquonock	30 00

§ Market Garden and Potato Manure shipped under wrong brand name.

WITHOUT POTASH—(*Continued.*)

Nitrogen.						Phosphoric Acid.							Station No.
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	
.....	0.02	0.18	0.96	1.16	0.80	9.30	2.37	0.23	11.90	11.0	11.67	10.0	8900
6.82	0.12	0.84	0.65	8.43	7.40	0.01	5.96	1.05	7.02	8.0	5.97	4.0	9081
3.83	0.12	0.31	0.75	5.01	5.00	5.59	2.28	1.05	8.92	6.0	7.87	5.0	9008
0.98	0.25	1.11	1.14	3.48	3.30	2.86	5.47	1.47	9.80	9.0	8.33	8.0	9091
0.81	0.10	0.44	0.67	2.02	1.70	9.20	2.06	0.59	11.85	11.0	11.26	10.0	9007
0.14	1.10	0.41	1.31	2.96	2.50	4.61	3.49	1.62	9.72	9.0	8.10	8.0	8929
0.10	1.34	1.10	2.38	4.92	4.50	2.76	3.20	0.19	6.15	6.0	5.96	5.0	9082
1.16	0.24	0.54	1.58	3.52	3.30	1.02	6.63	0.63	8.28	.....	7.65	7.0	9092
0.96	0.47	0.58	1.57	3.58	3.30	1.54	6.14	0.67	8.35	.....	7.68	7.0	9093
0.80	1.10	0.97	0.65	3.52	3.29	6.64	3.62	1.64	11.90	11.0	10.26	10.0	9127
3.50	3.82	0.58	0.38	8.28	8.29	4.45	1.75	0.27	6.47	6.0	6.20	5.0	9010
0.40	0.32	0.13	0.25	1.10	0.82	5.74	4.13	1.06	10.93	11.0	9.87	10.0	9009
0.54	1.92	0.61	1.24	4.31	4.11	5.28	3.11	1.46	9.85	9.0	8.39	8.0	8903
0.31	1.93	0.46	1.33	4.03	4.11	6.88	3.40	1.41	11.69	11.0	10.28	10.0	8930
0.22	0.40	0.56	0.64	1.82	1.65	5.45	5.26	1.30	12.01	11.0	10.71	10.0	8902
0.49	0.75	0.45	0.69	2.38	2.47	7.30	3.86	0.99	12.15	11.0	11.16	10.0	9083
0.95	1.25	0.61	0.61	3.42	3.29	7.08	3.61	1.27	11.96	11.0	10.69	10.0	8901
0.87	1.51	0.50	1.18	4.06	4.11	5.38	3.44	1.34	10.16	9.0	8.82	8.0	9084
0.64	0.46	0.70	0.88	2.68	2.47	5.55	4.68	1.71	11.94	11.0	10.23	10.0	9094
1.08	0.08	0.07	3.01	4.24	4.11	1.86	2.64	0.36	4.86	5.0	4.50	4.0	8931
0.60	0.52	0.33	0.34	1.79	1.65	6.04	4.05	1.68	11.77	11.0	10.09	10.0	9011
0.60	0.52	0.23	0.58	1.93	1.65	6.40	3.92	1.19	11.51	11.0	10.32	10.0	9085
0.44	1.36	0.77	0.98	3.55	3.29	6.89	4.27	0.87	12.03	11.0	11.16	10.0	8967
1.55	1.55	0.52	1.01	4.63	4.92	4.96	5.36	1.92	12.24	9.0	10.32	8.0	8932
1.27	0.15	0.63	0.84	2.89	2.47	7.72	2.96	1.00	11.68	11.0	10.68	10.0	8989
0.21	1.95	0.40	0.91	3.47	3.29	7.15	3.25	1.74	12.14	11.0	10.40	10.0	8904
1.07	0.12	0.17	3.10	4.46	4.53	1.76	2.31	0.43	4.50	4.0	4.07	3.0	9086
0.29	2.14	0.49	1.39	4.31	4.11	7.20	2.61	1.84	11.65	11.0	9.81	10.0	9287
1.02	0.86	0.39	0.47	2.74	2.47	6.29	4.07	1.09	11.45	11.0	10.36	10.0	9095
3.37	3.91	0.59	1.03	8.90	8.23	3.62	1.86	0.20	5.68	6.0	5.48	5.0	9096
0.80	0.95	0.73	1.11	3.59	3.29	5.56	4.43	1.19	11.18	11.0	9.99	10.0	9072
....	0.23	0.55	0.27	1.05	0.82	5.44	4.99	1.16	11.59	11.0	10.43	10.0	8990
0.38	1.75	0.78	1.23	4.14	4.10	7.89	2.38	1.13	11.40	11.0	10.27	10.0	9170
0.51	0.76	0.73	0.81	2.81	2.87	7.89	3.53	0.73	12.15	11.0	11.42	10.0	9097
0.68	0.98	1.30	0.34	3.30	3.28	7.13	4.51	0.86	12.50	11.0	11.64	10.0	9074
0.48	0.58	1.18	1.94	4.18	4.10	4.02	3.97	1.32	9.31	7.0	7.99	6.0	9098
0.33	0.46	1.59	0.44	2.82	2.46	7.80	3.71	0.90	12.41	11.0	11.51	10.0	9073

TABLE II—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station Agent:		
	The L. T. Frisbie Co., New Haven, Conn.		
8970	Connecticut Special for all Crops	New Britain	$35.00
8969	Corn and Grain Fertilizer	Norwich	35.00
9087	Market Garden and Top Dresser	Meriden	58.00
8968	Potato and Vegetable Grower	Guilford	....
8905	Tobacco Special	Suffield	35.00
9128	Tobacco Special	Windsor	35.00
	International Agricultural Corporation, Buffalo, N. Y.		
9099	Buffalo Farmers Choice	Plainfield	32.00
8991	Buffalo New England Special	West Cheshire	25.50
9314	Buffalo Standard	East Haven	38.00
9129	Buffalo Tobacco Grower	East Granby	....
†9130	Buffalo Top Dresser	Thompsonville	45.00
†9131	Buffalo Vegetable and Potato	Plainfield	34.00
	Lister's Agricultural Chemical Works, Newark, N. J.		
9135	Atlas Brand Fertilizer 1916	Stratford	.....
9134	Celebrated Tobacco Fertilizer without Potash	Warehouse Point	.....
9133	Complete Tobacco Fertilizer without Potash	Rockville	.....
8992	Plant Food 1916	Hamden	.....
9132	Superior Ammoniated Superphosphate 1916	Danbury	34.00
	Lowell Fertilizer Co., Boston, Mass.		
9137	Animal Brand	Moosup	32.50
9149	Bone Fertilizer	Wallingford	30.00
8971	Empress Brand	Southington	29.00
9147	Market Garden Special Grass and Lawn Dressing	Rockville	42.00
9146	Potato, Corn and Vegetable	Warehouse Point	.....
9136	Potato Manure	Saybrook	37.00
9145	Potato Phosphate	Southington	35.00
9148	Tobacco Grower	Somers	40.00
	E. Manchester and Sons, Winsted, Conn.		
9150	1917 Formula	Ellington	.....
	The Mapes Formula and Peruvian Guano Co., New York City.		
‡8972	5% Ammonia Special	Hartford	38.00
9151	5% Ammonia Special	Ellington	34.00
8973	1917 Special	Norwich	35.00
	National Fertilizer Co., New York City.		
9156	H. G. Top Dressing without Potash	Granby	60.00
9152	Nitrogen Phosphate Mixture No. 1	Winsted	25.00
9153	Nitrogen Phosphate Mixture No. 2	Ridgefield	45.00
9154	Nitrogen Phosphate Mixture No. 3	Newington	....
8993	Nitrogen Phosphate Mixture No. 4	West Cheshire	33.00
9155	Nitrogen Phosphate Mixture No. 5	Ellington	33.00
9171	Nitrogen Phosphate Mixture No. 6	Ellington	....
8974	Tobacco Special without Potash	Thompsonville	30.00

† See page 387. ‡ See page 390.

WITHOUT POTASH—(*Continued.*)

Nitrogen.						Phosphoric Acid.							Station No.
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	
0.34	0.48	0.69	0.79	2.30	2.46	7.60	3.43	0.78	11.81	11.0	11.03	10.0	**8970**
0.03	0.09	0.84	0.84	1.80	1.64	6.60	4.00	0.59	11.19	11.0	10.60	10.0	**8969**
0.91	1.44	0.73	1.06	4.14	4.10	7.61	3.23	0.58	11.42	11.0	10.84	10.0	**9067**
0.44	1.29	0.71	0.93	3.37	3.28	7.07	4.13	0.79	11.99	11.0	11.20	10.0	**8968**
0.69	0.09	1.61	1.82	4.21	4.10	3.60	3.75	1.43	8.78	7.0	7.35	6.0	**8905**
0.15	1.01	1.08	2.20	4.44	4.10	3.61	3.99	1.27	8.87	7.0	7.60	6.0	**9128**
0.49	0.05	0.12	0.40	1.06	0.80	6.83	3.00	1.39	11.22	11.0	9.83	10.0	**9099**
0.46	0.12	0.71	0.55	1.84	1.60	3.43	6.90	1.57	11.90	11.0	10.33	10.0	**8991**
1.67	0.08	0.80	0.95	3.50	3.30	3.24	6.58	3.34	13.16	11.0	9.82	10.0	**9314**
0.19	1.90	0.27	1.59	3.95	4.10	2.66	2.38	0.73	5.77	5.0	5.04	4.0	**9129**
2.66	0.83	0.61	0.68	4.78	5.80	2.30	5.66	2.02	9.98	7.0	7.96	6.0	**9130**
1.12	0.09	0.61	0.40	2.22	2.50	4.35	5.24	1.82	11.41	11.0	9.59	10.0	**9131**
1.35	1.44	0.47	1.06	4.32	4.11	6.56	2.32	1.01	9.89	9.0	8.88	8.0	**9135**
0.23	0.07	0.65	3.65	4.60	4.53	2.40	1.16	0.51	4.07	4.0	3.56	3.0	**9134**
1.05	1.04	1.12	0.96	4.17	4.11	1.14	3.84	1.38	6.36	5.0	4.98	4.0	**9133**
0.14	0.22	0.36	0.60	1.32	0.82	5.59	4.67	1.33	11.59	11.0	10.26	10.0	**8992**
0.70	0.28	1.18	1.24	3.40	3.29	2.13	6.15	2.67	10.95	11.0	8.28	10.0	**9132**
0.32	0.58	0.74	0.98	2.62	2.87	7.87	3.55	0.63	12.05	11.0	11.42	10.0	**9137**
0.37	0.11	0.74	0.84	2.06	2.05	6.79	3.43	1.51	11.73	11.0	10.22	10.0	**9149**
0.05	0.07	0.59	0.72	1.43	1.25	7.76	4.00	1.11	12.87	11.0	11.76	10.0	**8971**
0.53	1.66	1.32	1.47	4.98	4.92	5.40	4.05	1.19	10.64	9.0	9.45	8.0	**9147**
0.74	1.49	0.81	0.94	3.98	4.10	8.02	3.15	0.79	11.96	11.0	11.17	10.0	**9146**
0.38	0.65	0.72	0.94	2.69	2.46	7.43	3.83	0.50	11.76	11.0	11.26	10.0	**9136**
0.54	1.22	0.76	0.88	3.40	3.28	7.31	3.80	0.84	11.95	11.0	11.11	10.0	**9145**
0.27	0.05	1.71	2.19	4.22	4.10	4.10	3.23	1.11	8.44	7.0	7.33	6.0	**9148**
0.67	0.44	0.62	1.39	3.12	2.47	6.58	4.02	2.09	12.69	....	10.60	10.0	**9150**
3.50	0.04	0.09	0.50	4.13	4.12	2.74	6.51	2.28	11.53	10.0	9.25	8.0	**8972**
3.72	0.06	0.22	0.53	4.53	4.12	4.97	4.09	2.07	11.13	10.0	9.06	8.0	**9151**
3.96	0.03	0.29	0.50	3.78	3.29	4.94	4.18	1.56	10.68	10.0	9.12	8.0	**8973**
1.59	4.03	1.30	1.03	8.95	8.23	3.70	2.03	0.27	6.00	6.0	5.73	5.0	**9156**
0.03	0.10	0.36	0.52	1.01	0.82	4.67	5.95	1.01	11.63	11.0	10.62	10.0	**9152**
0.45	0.55	0.18	0.64	1.82	1.65	7.31	3.32	1.27	11.90	11.0	10.63	10.0	**9153**
0.36	0.62	0.52	1.03	2.53	2.47	6.25	4.25	1.01	11.51	11.0	10.50	10.0	**9154**
0.78	1.35	0.50	0.66	3.29	3.29	6.44	4.27	1.42	12.13	11.0	10.71	10.0	**8993**
1.62	1.13	0.66	0.80	4.21	4.11	5.60	3.48	1.56	10.64	9.0	9.08	8.0	**9155**
0.28	2.26	0.41	1.39	4.34	4.11	6.92	3.15	1.57	11.64	11.0	10.07	10.0	**9171**
1.28	0.08	0.01	3.58	4.95	4.53	1.53	2.41	0.54	4.48	4.0	3.94	3.0	**8974**

TABLE II—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station Agent:		
	New England Fertilizer Co., Boston, Mass.		
9172	Corn and Grain Fertilizer	Rockville	$29.0
9223	Corn Phosphate	Madison	....
9222	High Grade Potato Fertilizer	North Haven	36.0
†9173	Potato Fertilizer	Rockville	34.0
9174	Special Tobacco Manure	Warehouse Point	40.0
8994	Superphosphate	Meriden	35.0
	Olds and Whipple, Hartford, Conn.		
9175	High Grade Tobacco Starter	Windsor	....
9176	Special Grass Fertilizer	Hartford	38.5
8995	Special Phosphate	Silver Lane	33.5
9052	Tobacco Special Fertilizer	Hartford	37.5
9053	Tobacco Special Fertilizer	Hartford	37.5
9054	Tobacco Special Fertilizer	Hartford	37.5
9055	Tobacco Special Fertilizer	Hartford	37.5
	Parmenter and Polsey Fertilizer Co., Boston, Mass.		
9177	Grain Grower	Plantsville	30.0
8975	Plymouth Rock Brand	Highwood	....
9178	Potato Fertilizer	Bloomfield	32.0
9317	Special Tobacco Grower	Windsor	40.0
9179	Star Brand Superphosphate	Plantsville	32.0
	The Rogers and Hubbard Co., Portland, Conn.		
8996	Hubbard's Bone Base Oats and Top Dressing	Branford	52.0
9180	Hubbard's Bone Base Soluble Corn and General Crops Manure	Branford	38.0
9193	Hubbard's Bone Base Soluble Tobacco Manure	Portland	41.5
9199	Rogers' All Soils—All Crops Phosphate	Portland	....
9200	Rogers' Climax Tobacco Brand	Portland	....
9195	Rogers' Complete Phosphate	Black Hall	30.0
9201	Rogers' H. G. Oats and Top Dressing	Somers	....
9202	Rogers' H. G. Soluble Corn and Onion Manure	Black Hall	35.0
*8997	Rogers H. G. Soluble Tobacco Manure	Milford	45.0
*9347	Rogers' H. G. Soluble Tobacco Manure	Wapping	43.0
9203	Rogers' Potato Phosphate	Mansfield Depot	32.0
9194	R. and H. All Soils—All Crops Phosphate	Wethersfield	....
9196	R. and H. Complete Phosphate	Willimantic	33.0
9197	R. and H. Potato Phosphate	Stafford Springs	40.0
9198	R. and H. Valley Tobacco Brand	Portland	....
	F. S. Royster Guano Co., Baltimore, Md.		
*9225	Curfew Ammoniated Superphosphate	Branford	37.0
*9348	Curfew Ammoniated Superphosphate	Madison	34.0
*9228	Goodwill Ammoniated Superphosphate	Plainville	39.5
*9404	Goodwill Ammoniated Superphosphate	Windsor	38.5
9227	Innovation Ammoniated Superphosphate	Branford	32.0
9204	Penguin Ammoniated Superphosphate	Waterbury	30.0
9229	Stevens' Formula	Glastonbury	36.0
9226	Valley Tobacco Compound	Windsor	38.5

† See page 387. * See page 393.

WITHOUT POTASH—(*Continued.*)

Nitrogen.						Phosphoric Acid.							
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.04	0.12	0.51	0.69	1.36	1.23	5.91	3.72	1.83	11.46	11.0	9.63	10.0	9172
0.10	0.42	0.72	0.78	2.02	2.05	7.58	3.74	0.91	12.23	11.0	11.32	10.0	9223
0.63	1.12	0.63	0.93	3.31	3.28	7.46	3.72	0.87	12.05	11.0	11.18	10.0	9222
0.30	0.62	0.92	0.49	2.33	2.46	5.53	4.00	2.12	11.65	11.0	9.53	10.0	9173
0.71	0.09	1.01	2.29	4.10	4.10	4.09	3.53	1.18	8.80	7.0	7.62	6.0	9174
0.59	0.78	0.71	0.90	2.98	2.87	7.65	3.67	0.58	11.90	11.0	11.32	10.0	8994
3.37	0.21	0.21	5.85	9.64	9.06	2.49	2.41	0.60	5.50	3.0	4.90	3.0	9175
1.92	0.10	0.75	2.78	5.55	4.95	0.79	3.24	3.07	7.10	4.0	4.03	4.0	9176
1.58	0.04	0.89	2.07	4.58	4.11	0.56	3.28	3.54	7.38	4.0	3.84	4.0	8995
0.96	0.07	0.39	3.08	4.50	4.11	1.65	2.14	0.37	4.16	3.0	3.79	3.0	9052
....	....	....	....	4.31	4.11	....	....	....	3.94	3.0	.....	.....	9053
....	....	....	....	4.16	4.11	....	....	....	3.58	3.0	.....	.....	9054
....	....	....	....	4.26	4.11	....	....	....	3.67	3.0	.....	.....	9055
0.05	0.06	0.70	0.68	1.49	1.23	7.99	2.96	0.97	11.92	11.0	10.95	10.0	9177
0.56	0.78	0.83	0.99	3.16	2.88	7.51	3.89	0.60	12.00	11.0	11.40	10.0	8975
0.04	0.50	0.73	0.76	2.03	2.05	7.40	3.75	0.75	11.90	11.0	11.15	10.0	9178
0.18	0.04	1.50	2.18	3.90	4.10	4.08	3.44	1.24	8.76	7.0	7.52	6.0	9317
0.32	0.69	0.62	0.79	2.42	2.46	7.11	3.55	0.55	11.21	11.0	10.66	10.0	9179
5.31	0.14	0.37	0.44	6.26	6.00	0.00	6.52	6.32	12.84	12.0	6.52	6.0	8996
0.54	0.84	0.33	0.79	2.50	2.50	1.45	7.78	4.55	13.78	12.0	9.23	10.0	9180
2.97	0.79	0.43	0.85	5.04	5.00	0.02	9.33	3.51	12.86	12.0	9.35	10.0	9193
2.53	0.15	0.13	0.68	3.49	3.30	3.70	3.96	1.41	9.07	8.0	7.66	7.0	9199
0.93	1.10	0.29	2.50	4.82	4.12	0.03	1.98	1.88	3.89	4.0	2.01	3.0	9200
0.20	0.05	0.27	0.57	1.09	1.00	3.67	3.38	2.61	9.66	9.0	7.05	8.0	9195
5.71	0.14	0.26	0.38	6.49	6.00	0.00	6.58	5.65	12.23	12.0	6.58	6.0	9201
0.54	0.70	0.51	0.86	2.61	2.50	0.78	8.73	4.63	14.14	12.0	9.51	10.0	9202
1.61	1.75	0.60	1.04	5.00	5.00	0.07	8.65	4.25	12.97	12.0	8.72	10.0	8997
2.20	1.32	0.50	0.91	4.93	5.00	0.21	8.51	4.12	12.84	12.0	8.72	10.0	9347
0.45	0.56	0.55	0.66	2.22	2.00	6.36	5.47	3.85	15.68	14.0	11.83	13.0	9203
2.66	0.34	0.48	0.52	4.00	3.30	2.15	4.55	2.15	8.85	8.0	6.70	7.0	9194
0.17	0.21	0.37	0.71	1.46	1.00	3.77	3.60	2.92	10.29	9.0	7.37	8.0	9196
0.32	1.02	0.21	0.62	2.17	2.00	9.58	4.89	1.29	15.76	14.0	14.47	13.0	9197
1.68	0.28	0.25	2.53	4.74	4.12	0.12	1.86	1.97	3.95	4.0	1.98	3.0	9198
0.07	1.32	0.63	1.00	3.02	3.29	6.69	2.34	0.73	9.76	8.5	9.03	8.0	9225
0.04	1.50	0.55	1.13	3.22	3.29	6.16	2.06	0.59	8.81	8.5	8.22	8.0	9348
0.16	1.80	0.50	1.38	3.84	4.11	6.57	1.96	0.49	9.02	8.5	8.53	8.0	9228
0.14	1.92	0.46	1.68	4.20	4.11	6.89	1.57	0.51	8.97	8.5	8.46	8.0	9404
0.04	1.03	0.50	0.88	2.45	2.47	6.00	2.29	0.68	8.97	8.5	8.29	8.0	9227
0.12	0.82	0.24	0.50	1.68	1.65	6.28	3.88	1.37	11.53	10.5	10.16	10.0	9204
0.16	0.89	0.37	2.59	4.01	4.11	3.59	2.60	1.04	7.23	6.5	6.19	6.0	9229
0.25	0.67	0.30	2.89	4.11	4.11	3.27	2.71	0.77	6.75	6.5	5.98	6.0	9226

TABLE II—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station Agent:		
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
*8907	H. G. Ammoniated Phosphate	Stratford	$33 [illegible]
*9075	H. G. Ammoniated Phosphate	Orange	30 [illegible]
*9308	H. G. Ammoniated Phosphate	Highwood	[illegible]
9224	Phosphate without Potash	Plainville	30 [illegible]
8906	Special without Potash	Stratford	29 [illegible]
	The C. M. Shay Co., Groton, Conn.		
9231	4–8	Groton	33.00
	M. L. Shoemaker and Co., Philadelphia, Pa.		
8998	"Swift-Sure" Superphosphate for Tobacco and General Use	Hartford	39 [illegible]
	Springfield Rendering Co., Springfield, Mass.		
9230	Animal Fertilizer	Thompsonville	33.00
	Virginia-Carolina Chemical Co., New York City.		
9233	Ammoniated Bone Phosphate for all Crops	Norwich	28.00
8999	H. G. Corn and Vegetable Compound without Potash	Norwich	32.00
9232	Indian Brand for Tobacco (C. S. M.) without Potash	Glastonbury	35.00
9309	Special Top Dresser	Milford	40.00
9310	20th Century Potato Manure without Potash	Winsted	37.00
	Wilcox Fertilizer Co., Mystic, Conn.		
9311	Complete Bone Superphosphate	Rockville	26.00
9048	Corn Special	Hartford	34 [illegible]
8886	Grass Fertilizer	Meriden	30 [illegible]
	Worcester Rendering Co., Auburn, Mass.		
9312	Royal Worcester Corn and Grain Fertilizer	Norwich	28 [illegible]
9313	Royal Worcester Potato and Vegetable Fertilizer	Norwich	33 [illegible]
	Sampled by Purchasers and Others:		
8713	Amer. Agr. Chem. Co.'s Complete Tobacco Fertilizer without Potash	*E. Windsor Hill:*—Keiser & Boasberg Plant.	37 [illegible]
8714	Amer. Agr. Chem. Co.'s Complete Tobacco Fertilizer without Potash	*E. Windsor Hill:*—Keiser & Boasberg Plant.	37 [illegible]
8715	Amer. Agr. Chem. Co.'s Complete Tobacco Fertilizer without Potash	*E. Windsor Hill:*—Keiser & Boasberg Plant.	37 [illegible]
8716	Amer. Agr. Chem. Co.'s Complete Tobacco Fertilizer without Potash	*E. Windsor Hill:*—Keiser & Boasberg Plant.	37 [illegible]
9400	Amer. Agr. Chem. Co.'s Grain and Seeding Fertilizer	*Stafford:*—F. L. Upham	27 [illegible]

* See page 393.

WITHOUT POTASH—(*Continued.*)

Nitrogen.						Phosphoric Acid.							Station No.
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	
0.48	0.12	1.13	1.66	3.39	3.29	2.62	6.49	6.82	15.93	11.0	9.11	10.0	**8907**
1.58	0.15	0.40	1.51	3.64	3.29	8.82	3.74	1.33	13.89	11.0	12.56	10.0	**9075**
1.60	0.11	0.73	0.96	3.40	3.29	4.62	6.29	0.49	11.40	11.0	10.91	10.0	**9308**
0.18	0.13	0.56	0.95	1.82	1.65	1.97	8.22	2.26	12.45	11.0	10.19	10.0	**9224**
0.35	0.13	0.74	1.45	2.67	2.47	4.11	6.08	4.14	14.33	11.0	10.19	10.0	**8906**
0.76	0.12	1.45	1.11	3.44	3.28	3.26	5.20	1.89	10.35	10.0	8.46	8.0	**9231**
1.06	0.05	0.96	1.63	3.70	3.29	6.97	4.21	1.59	12.77	12.0	11.18	9.0	**8998**
0.50	0.45	1.01	0.81	2.77	2.46	8.43	3.20	0.42	12.05	11.0	11.63	10.0	**9230**
0.12	0.78	0.39	0.51	1.80	1.65	6.66	2.77	1.37	10.80	11.0	9.43	10.0	**9233**
0.01	1.05	0.70	0.89	2.65	2.47	7.80	2.78	0.93	11.51	11.0	10.58	10.0	**8999**
1.12	0.46	0.41	2.13	4.12	4.11	1.57	2.42	6.41	10.40	5.0	3.99	4.0	**9232**
0.24	1.58	1.32	1.76	4.90	4.94	6.51	2.01	1.78	10.30	9.0	8.52	8.0	**9309**
0.21	1.91	0.68	1.48	4.28	4.12	9.01	1.64	0.86	11.51	11.0	10.65	10.0	**9310**
0.79	0.28	0.15	1.24	2.46	1.65	7.91	2.71	0.88	11.50	11.0	10.62	10.0	**9311**
0.55	0.14	0.73	2.30	3.72	3.30	4.22	5.43	3.57	13.22	11.0	9.65	10.0	**9048**
2.67	0.05	1.84		4.56	4.12	7.39	3.41	1.25	12.05	9.0	10.80	8.0	**8886**
0.85	0.58	0.68	0.61	2.72	2.05	8.49	5.19	3.03	16.71	11.0	13.68	10.0	**9312**
1.35	0.45	1.16	1.29	4.25	3.28	5.20	5.25	4.03	14.48	11.0	10.45	10.0	**9313**
....	....	....	....	4.52	4.53	.. .	....	....	4.64	4.0	.....	3.0	**8713**
....	....	....	....	4.58	4.53	....	....	....	4.72	4.0	.....	3.0	**8714**
....	....	....	....	4.52	4.53	....	....	....	4.50	4.0	.....	3.0	**8715**
....	....	....	....	4.66	4.53	....	....	....	4.43	4.0	.....	3.0	**8716**
0.73	0.74	0.73		2.20	1.65	6.52	3.95	1.56	12.03	11.0	10.47	10.0	**9400**

TABLE II—NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Purchasers and Others:		
8737	Quinnipiac Wrapper Brand	*Hartford*:—Haviland Tobacco Co.	$37.50
8738	Quinnipiac Wrapper Brand	*Hartford*:—Haviland Tobacco Co.	37.50
8739	Quinnipiac Wrapper Brand	*Hartford*:—Haviland Tobacco Co.	37.50
8962	Apothecaries Hall Co.'s Victor Potato Special	*West Cheshire*:—Whitcomb & Hadley	36.00
9144	Frisbie's Tobacco Fertilizer	*Suffield*:—E. S. Seymour	32.50
9138	Rogers & Hubbard's All Soils—All Crops Phosphate	*Portland*:—John Gotta.	31.00
9139	Hubbard's Bone Base Soluble Tobacco Manure	*Portland*:—John Gotta.	42.00
§8751	Royster's Valley Tobacco Compound	*Avon*:—P. H. Woodford	.....
8766	Royster's Valley Tobacco Compound	*New Milford*:—L. W. Marsh	.....
9394	Sanderson's High Grade Ammoniated Phosphate	*Branford*:—A. E. Plant Sons Co.	.....
9060	Sanderson's High Grade Ammoniated Phosphate	*Cheshire*:—T. L. Chipman	.....
9395	Sanderson's Top Dresser	*Branford*:—A. E. Plant Sons Co.	.....
9407	Shay's 4–10	*New London*:—J. M. Graves	37.00
8810	Virginia-Carolina Chem. Co.'s Indian Brand for Tobacco without Potash	*Addison*:—Chas. Bell	35.65
8774	Unknown brand	*Cornwall*:—O. E. Temple	.....
8861	5–10 Fertilizer	*Roxbury*:—J. G. Butler	.....

§Contains .078% of potash as muriates.

WITHOUT POTASH—(*Concluded.*)

Nitrogen.						Phosphoric Acid.							Station No.
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic water-soluble.	Organic water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble	Found.	Guaranteed.	Found.	Guaranteed.	
....	....	....	....	4.58	4.53	....	....	....	4.22	4.0	.....	3.0	8737
....	....	....	....	4.76	4.53	....	....	....	4.48	4.0	.....	3.0	8738
....	....	....	....	4.58	4.53	....	....	....	4.80	4.0	.....	3.0	8739
....	....	....	....	2.65	2.47	....	....	....	15.48	11.0	.....	10.0	8962
....	....	....	....	3.90	4.10	....	....	....	8.30	7.0	.....	6.0	9144
....	....	....	....	3.34	3.30	....	....	....	9.31	8.0	.....	7.0	9138
....	....	....	....	5.10	5.00	....	....	....	12.59	12.0	.....	10.0	9139
....	....	....	....	4.35	4.11	....	....	....	6.97	....	.....	6.0	8751
....	....	....	....	4.45	4.11	....	....	....	6.68	....	.....	6.0	8766
....	....	....	....	3.39	3.29	....	....	....	11.78	11.0	.....	10.0	9394
....	....	....	....	3.40	3.29	....	....	....	10.96	11.0	.....	10.0	9060
....	....	....	....	3.39	3.29	....	....	....	12.60	11.0	.....	10.0	9395
0.11	0.38	2.45		2.94	3.29	2.11	4.36	1.42	7.89	....	6.47	10.0	9407
....	....	....	....	4.06	4.12	....	.. .	....	4.95	5.0	.....	4.0	8810
....	....	....	....	1.11	....	.. .	....	....	8.32	....	.....	....	8774
....	....	....	....	4.26	4.12	....	....	....	11.71	....	.....	10.0	8861

VI. MISCELLANEOUS FERTILIZERS, LIME, ASHES, ETC.

SHEEP MANURE.

9211. Pulverized Sheep Manure. Sold by American Agricultural Chemical Co., New York City. Stock of Geo. S. Phelps & Co., Thompsonville.

9206. Sheep Manure. Sold by L. T. Frisbie Co., New Haven. Sampled and sent by F. S. Burnett, New Haven.

9349. Sheep Manure. Sold by L. T. Frisbie Co., New Haven. Stock of G. F. Peters & Son, Highwood.

9267. Sheep's Head Pulverized Sheep Manure. Sold by Natural Guano Co., Aurora, Ill. Stock of Frank S. Platt Co., New Haven.

9270. Wizard Brand Manure. Sold by Pulverized Manure Co., Chicago. Stock of Frank S. Platt Co., New Haven.

8896. Pulverized Sheep Manure. Sampled and sent by H. E. Larsen, Mt. Carmel.

9713. Chicago Feed & Fertilizer Co.'s Ground Sheep Manure. For analysis see page 422.

Station No.	9211	9206	9349	9267	9270	8896
Per cent. of						
Nitrogen as nitrates	0.10	...	0.12	....	....	....
" as ammonia	0.14	...	0.02	0.22	0.26	....
" as organic	1.94	....	1.45	1.93	1.72	....
" total found	2.18	2.07	1.59	2.15	1.98	2.31
" total guaranteed	2.06	....	0.82	2.25	1.80	....
Phosphoric acid, water-soluble	1.04	....	0.17	0.76	0.85	....
" " citrate-soluble	0.36	....	1.67	0.79	0.50	....
" " citrate-insoluble	0.15	....	0.22	0.13	0.13	....
" " total found	1.55	2.52	2.06	1.68	1.48	2.99
" " total guaranteed	1.25	....	2.00	1.25	1.00	....
Water-soluble potash found	1.81	0.97	0.74	3.14	2.00	1.03
" " guaranteed	1.00	....	0.97	1.50	1.00	....
Chlorin	....	....	0.08	0.38	0.90	....
Cost per ton	$38.00	....	....	31.00	31.00	35.00

These dried manures are chiefly of interest to florists and to greenhouse or lawn owners. As we have said in previous reports, they are out of the question for general farm use, because horse manure supplies three or four times as much plant food for the same money, and the extra vegetable matter should be supplied in farm crops and residues.

WOOD ASHES.

Twenty samples called "wood ashes" were analyzed. Three of these, **8862, 8811** and **8698,** have the character of lime-kiln ashes and contain very little potash. The remaining samples are good, bad or indifferent. Nine samples contained from 4.7 to 6.8 per cent. of potash; four from 2.8 to 3.7 per cent., and four from 0.8 to 1.7 per cent.

The prices were exceedingly variable; for instance, $9.00 per ton for material containing 2.8 per cent. of potash; $16.00 for ashes containing 1.5 per cent. and $27.50 for one containing 4.72 per cent. Certain of the higher grades were sold on the unit basis, the price ranging from $4.50 to $6.00 per unit of water-soluble potash.

The extreme variability in the potash content of wood ashes emphasizes the necessity of always buying it on a definite guaranty of water-soluble potash.

Only three of the samples were accompanied by a guaranty, **9372, 9025** and **8862.** These were guaranteed 2.00, 5.03 and 3.00 per cent. of potash, respectively, and contained 1.50, 4.72 and 0.07 per cent.

HOUSEHOLD WASTES.

At the present time, when the prices for potash fertilizers are almost prohibitive, any available source of this important element is a matter of interest. Possibly few householders realize the fertilizer value of many of their household wastes which they usually throw away. The actual content of potash in any of these is small, but may be worth saving.

The samples, whose analyses are given in the accompanying table, were for the most part prepared by Prof. P. E. Browning, of Yale University, and submitted by him to us for analysis. It is to be regretted that the actual percentages of ash were not determined, as the information thus supplied would have been valuable. The results, however, are suggestive, and indicate how much valuable fertilizer material in the aggregate is thrown away by the American public. Many of these ashes could be prepared in the ordinary open fireplace of the average home and could be collected with the ashes from the wood there burned. The citrus fruit skins, because of their oil, burn readily, and our analyses show how rich in potash their ashes are. The analyses also suggest the utility of community incinerating plants as a means of conserving the important amounts of potash which some household wastes contain.

ANALYSES OF WOOD ASHES.

Station No.	Car No. and Purchaser or Dealer.	Water.	Insoluble in acid (sand)	Water-soluble Potash.	Lime.	Phosphoric Acid.	Cost per ton.
9372	John Joynt, Lucknow, Ont. I. Lockwood, New Canaan	....	....	1.50	29.27	1.29	$16.00
8771	John Joynt, Lucknow, Ont. 103660 J. E. Lathrop, East Hartford	....	36.17	1.54	.....	....	.....
8949	Olds & Whipple, Hartford. 64531 J. B. Stewart, Windsor	....	12.45	6.56	33.62	2.01	*
8950	Olds & Whipple, Hartford. 7813 E. P. Brewer, Silver Lane	....	10.43	6.15	35.04	2.17	*
8765	Olds & Whipple, Hartford. 17976 C. F. Segee, East Hartford	....	6.66	5.03	.....	....	.....
9020	Olds & Whipple, Hartford. 24976 John Wolf, Windsor	....	....	6.39	.....	....	*
9025	Olds & Whipple, Hartford. H. W. Ferry, So. Glastonbury	....	6.60	4.72	36.86	2.00	27.50
9253	Olds & Whipple, Hartford. 3719 W. S. Pinney, Suffield (John Joynt)	....	....	6.50	.....	....	*
9391	Olds & Whipple, Hartford. 76590 James Conroy, Warehouse Point	....	....	0.73	.....	1.44	*
9140	J. E. Perkins, Warehouse Point. 29942 A. E. Pascoe, Warehouse Point	....	....	2.82	25.88	1.93	9.00
8862	John Meehan & Son, N. Y. City. K. Tobacco Corp., Tariffville	10.45	7.66	0.07	52.70	0.22	15.00
9219	W. L. Mitchell, New Haven. Comstock, Ferre & Co., Wethersfield	....	.....	3.66	.....	....	.....
8951	W. L. Mitchell, New Haven. 76551 K. C. Kulle, Suffield	....	10.92	5.84	34.42	1.78	†
8895	W. L. Mitchell, New Haven. 8507 K. C. Kulle, Suffield	....	.....	6.78	.....	2.55	.....
8757	Chas. Stevens, Napanee, Ont. Albert Carini, So. Glastonbury	....	17.79	3.25	.....	....	.....
8811	Roy Hayes, Granby. E. H. Rollins, Granby	....	8.29	0.11	.....	0.20	15.50
8933	E. M. Brown, Hartford	....	13.95	2.83	29.97	1.30	.....
9021	M. E. Crawford, New Canaan	....	13.37	1.71	32.42	1.52	.....
9023	N. Jones, So. Windsor	....	13.24	6.04	31.50	1.65	.....
8698	Conn. Sumatra Tobacco Co., Hartford	....	.....	0.08	.....	....	.....

* $6 per unit of potash.

† $4.50 per unit of potash.

ANALYSES OF THE ASHES OF HOUSEHOLD WASTES.

	Phosphoric Acid.	Water-Soluble Potash.
Apple Skin Ash	3.08	11.74
Banana Skin Ash	3.25	41.76
Banana Stalk Ash (yellow)	2.34	49.40
Banana Stalk Ash (red)	3.04	46.64
Banana Stalk Ash (soluble salts)	?	45.28
Banana Stalk juice, evaporated, acidified	1.91	35.58
Banana Stalk juice, evaporated	2.25	4020.*
Cantaloupe Rind Ash	9.77	12.21
Cigar and Cigarette Ashes	2.57	16.81
Coal Ashes, sifted	0.32	0.16
Coffee Grounds (percolated)	0.36	0.67†
Cucumber Skin Ash	11.28	27.20
Egg Shells, burned	0.43	0.29‡
Grape Fruit Skin Ash	3.58	30.64
Grape Fruit Skin Ash (soluble salts)	?	56.92
Maine Coast Kelp Ash	1.93	21.70
Orange Skin Ash	2.90	27.04
Peach Skin Ash	6.31	30.76
Peach Stone Ash	3.25	6.04
Peanut Shell Ash	1.23	6.45
Pea Pod Ash	1.79	9.00
String Beans Ash (stems and strings)	4.99	18.09
Sweet Potato Skin (boiled) Ash	3.29	13.89
Tea Leaves Ash	1.60	0.44
White Potato Skin (raw) Ash	5.18	27.54
Wood Ashes	1.06	6.41
Wood Ashes, after burning citrus fruit skins	1.13	3.22

GROUND LIMESTONE.

8686. Grangers' Lime Co., West Stockbridge, Mass. Stock of Walter Hine, Orange. Cost $3.50 per ton.

8700. Grangers' Lime Co., West Stockbridge, Mass. "200 Mesh." Stock of J. W. Alsop, Avon.

8736. Grangers' Lime Co., West Stockbridge, Mass. "200 Mesh." Stock of H. K. Taylor, Griffins.

8709. Grangers' Lime Co., West Stockbridge, Mass. "200 Mesh." Stock of W. J. Reeves, Windsorville.

9534. Grangers' Lime Co., West Stockbridge, Mass. Stock of S. Heath, New Canaan.

ANALYSES OF LIMESTONE.

Station No.	8686	8700	8736	8709	9534
Per cent. of					
Lime	37.96	50.60	50.35	50.62	52.08
Magnesia	8.54	§	§	§	0.77
Insoluble in acid	14.68	6.35	6.81	6.24	7.22

* Contains also 0.45% nitrogen.
† Contains also 1.99% nitrogen.
‡ Contains also 52.12% lime.
§ Not determined.

8686 contains 67.72 per cent. of calcium carbonate and 17.85 per cent. of magnesium carbonate. The other four samples are quite pure calcitic limestones, containing from 89.84 to 92.91 per cent. of calcium carbonate.

HUMUS, MUCK, PEAT, ETC.

Two samples of commercial humus and five samples of muck were analyzed.

8685. Alphano Humus. Sent by Charles Henderson, Farmington. Cost $10.00 per ton.

9062. Commercial Humus. Sent by Commercial Humus Co., Newark, N. J. Claimed to contain on dry basis; nitrogen 2.60, phosphoric acid 1.10, potash 0.51, lime 2.90, magnesia 0.50, ash 20.12, and organic matter 75 per cent.

8889. Sent by M. F. Dallen, Willimantic, from a deposit stated to be 20 feet deep, covering several acres.

9478, 9479, 9480. Sent by A. Sartore, Waterbury.

8769. Sent by G. L. Cass, So. Britain.

Station No.	8685	9062	8889	9478	9479	9480	8769
Composition as received:							
Water	36.72	69.86	8.82	85.99	77.41	68.87	75.51
Mineral matter	22.32	9.83	10.72	1.28	3.18	2.81	11.55
Organic matter	40.96	20.31	80.46	12.73	19.41	28.32	12.94
Nitrogen	1.48	0.52	2.26	0.42	0.54	0.59	0.33
Phosphoric acid	1.11	0.02	*	*	*	*	*
Potash	*	0.03	*	*	*	*	*
Lime	4.19	*	*	*	*	*	*
Insoluble in acid	11.22	*	*	*	*	*	*
On water-free basis:							
Mineral matter	35.27	32.61	11.76	9.14	14.08	9.03	47.16
Organic matter	64.73	67.39	88.24	90.86	85.92	90.97	52.84
Nitrogen	2.19	1.73	2.48	3.00	2.39	1.90	1.35
Phosphoric acid	1.75	0.06	*	*	*	*	*
Potash	*	0.11	*	*	*	*	*

The two commercial samples contain much more mineral matter and, consequently, less vegetable matter than four of the samples from local deposits. It will be noted that **9062** contains less of all the ingredients claimed except mineral matter, containing only two-thirds of the nitrogen, one-twentieth of the phosphoric acid and one-fifth of the potash claimed.

* Not determined.

TOBACCO WASTES.

8410. Tobacco Stems. Sold by Olds and Whipple, Hartford. Sampled and sent by H. E. Wells, East Windsor Hill.

8851. Tobacco Stems. Sampled and sent by A. T. Henry, Wallingford.

8850. Tobacco Waste Ash. Sampled and sent by A. T. Henry, Wallingford.

8848. Tobacco Dust. Sampled and sent by J. Rosenberg & Co., Hartford.

8702. Tobacco Dust. Sampled and sent by Morgan & Dickinson, Windsor.

	8410	8851	8850	8848	8702
Nitrogen	1.97	2.80	....	2.78	1.64
Phosphoric acid	0.56	0.79	1.10	0.69	0.42
Potash, total	6.67	5.27	6.10	2.88	2.50

MISCELLANEOUS MATERIALS.

9339. Spent Hops. Sent by Arthur Mather, Hartford.

Water	79.50
Mineral matter	1.52
Organic matter	18.98
Nitrogen	0.81
Phosphoric acid	0.31
Potash	0.05

9141. Coffee Chaff. Sent by Morris West, Glastonbury. It contained nitrogen 1.92, phosphoric acid 0.15 and potash 1.63 per cent.

8959. Coffee Grounds. Waste from manufacture of G. Washington Coffee. Sent by manufacturer.

Nitrogen	0.81
Phosphoric acid	0.016
Potash	0.166
Water	60.50

8952. Ground Star Fish. Sent by F. L. Homan, New Haven.

Nitrogen	4.48
Phosphoric acid	0.42
Lime	24.32

8953. Musselizer ("Mussel Mud," "Nature's Own Fertilizer"). Sold by Agricultural Development Co., Lewiston, Me. Sent by F. P. Hubbard, Middletown.

8854. Marsh and Marine Mud. Sent by G. D. Tillinghast, Westerly.

	8953	8854
Nitrogen	0.82	0.28
Phosphoric acid	....	0.09
Potash	0.18	0.03

8832. Kelp. Sent by E. E. Burwell, New Haven. It contained nitrogen 1.83, phosphoric acid 0.64 and potash 2.64 per cent.

8749. Chimney Soot. Sent by Donahoe Bros., Middletown. It contained 0.31 per cent. of nitrogen.

8759. Ashes from factory sweepings. Sent by Waterbury Mfg. Co., Waterbury. It contained 0.08 per cent. of potash and 70.02 per cent. of material insoluble in acid. Copper was present.

9280. Lye used for cleaning type. Sent by W. C. Sharpe, Seymour. It contained 0.34 per cent. of potash, no nitrogen, traces of phosphoric acid and sulphates, and much carbonate. Its reaction was strongly alkaline.

8855. Sample apparently incorrectly tagged "Dry Ground Fish." Stock of George S. Phelps Co., Thompsonville. A mixed fertilizer of unknown brand. It contained 5.15 nitrogen, 8.18 "available" phosphoric acid, 9.54 total phosphoric acid and 0.86 per cent. potash.

SOILS.

Six samples of soils were tested for acidity. The details are of no general interest.

9713. Ground Sheep Manure. Sold by the Chicago Feed & Fertilizer Co., Chicago. Sampled and sent by the F. S. Platt Co., New Haven. Contained—nitrogen, 2.74; total phosphoric acid, 2.84; water-soluble potash, 2.07; guaranteed respectively 1.85, 1.50 and 1.25 per cent.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 205 APRIL, 1918

ENTOMOLOGICAL SERIES, No. 25

BEEKEEPING FOR CONNECTICUT

By A. W. YATES

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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BEEKEEPING FOR CONNECTICUT.

By A. W. Yates.

Introduction.

Beekeeping is a possible source of both pleasure and profit requiring a small amount of attention. Honey has considerable value as food, and in these days of food conservation and shortage of sugar, its value is correspondingly greater than in normal times. Beeswax is also valuable and both honey and wax find a ready market. Beekeeping has never been properly developed in Connecticut. There are many beekeepers, each with a few colonies, but in most cases the bees are left to shift for themselves. There is need of more bees in the hands of energetic beekeepers, who will give them more intelligent care.

The outlook for honey production never was better, from the money standpoint, than at present, and the possibilities, through the suppression and control of infectious diseases, are much greater in recent years; therefore it is hoped that this bulletin, while not complete or by any means final, may encourage more people to keep bees, and induce those who already have them to give them better care, so that beekeeping and honey production generally will be much improved. Bees on the farm, if rightly managed, will prove very often the best paying investment the farmer has for the amount of capital and time expended, and farmers who become interested in apiculture will often find that the profits far exceed their expectations. Bees not only are valuable as honey producers but are of great value as pollen carriers, fertilizing a great many fruit and vegetable crops, thus increasing their productiveness.

The sting, no doubt, is the reason why beekeeping is not more popular. This, however, can be almost entirely avoided by the use of the smoker and veil, and by the keeping of races of bees that are less prone to stinging. Of course, all honey-gathering bees have stings and will use them when aroused, but some races, such as the Italians and Carniolans, are much less given to using them.

Almost any persons, except those of a nervous temperament, can keep bees if they desire. Although there are many hundreds of beekeepers in the state, only a very small percentage make apiculture their sole occupation. There are locations, without doubt, where an experienced beekeeper would be well paid for devoting his whole time to the pursuit. Almost any location in

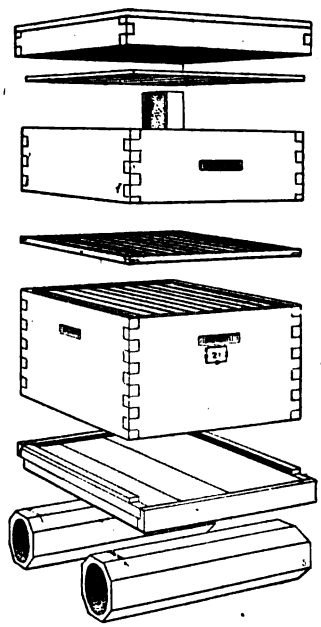


Figure 5. A ten-frame hive with comb-honey super and perforated zinc queen excluder. (After Phillips, Bureau of Entomology, U. S. Department of Agriculture.)

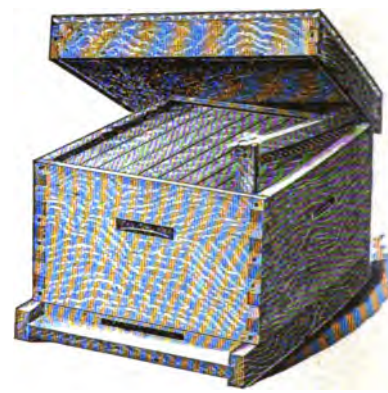


Figure 6. One-story Standard hive with metal cover. (After the A. I. Root Co.)

Figure 7. New Special section-frame super. (After the A. I. Root Co.)

the state would support a few colonies with profit to their owner. Backyards in cities and villages, or barren places in the country, could be utilized for this purpose with surprising results.

Beekeeping is also popular with invalids and people of sedentary habits, affording them mental relief and healthful, outdoor exercise. The apiary inspectors of this department are always ready to give instruction or information to those desiring it. One or more of

the text books or pamphlets listed in the back of this bulletin will be found helpful.

The hives and accessories illustrated and described in the following pages are such as have been tested by practical beekeepers and can be recommended to the beginner.

He must remember, however, that beekeeping is no "get-rich-quick" scheme. To succeed and to secure a crop of honey requires work, and work at the right time. A little delay at such times may spell failure. Poor seasons intervene when colonies will have to be fed to take them through the winter and it may need a good deal of enthusiasm on the part of the beekeeper to keep up his courage. These seasons, however, do not occur very often and the practical beekeeper knows that he must make the best of them.

HIVES.

Before starting beekeeping it is well to decide on the style of hives to be used and some other necessary equipment. The bees are as contented in an old box or tub as in the best modern hive, but for economical production of honey a carefully made hive is essential. Below are described two of the most popular kinds.

THE STANDARD OR LANGSTROTH HIVE.

This is the regular standard hive used by nearly all practical beekeepers and shown in figure 6. A more thorough description is given in supply catalogs. The hive consists of a bottom board, the brood chamber or living quarters, which is a box containing either eight or ten movable frames, and a cover. This hive, less a few minor improvements, was invented in 1851 by the Rev. L. L. Langstroth and is sometimes called the Langstroth hive. It was his knowledge of the peculiarities of the bee that enabled him to invent a hive that revolutionized beekeeping. All other movable frame hives are but modifications of this, though some of them are but poor substitutes.

It is usually better for the beekeeper to buy his hives in the flat, nailing them together himself, rather than to try to make them, especially if he values his time at anything. Factory-made hives are made with great accuracy.

This hive being adopted as the standard, it is very reasonable to suppose that it combines within itself more good qualities than any other and should therefore have the preference.

THE SUPER.

Above this standard hive and beneath the cover, is placed a shallow box or frame holding the comb-honey sections and called a "super." The super is shown in figures 7–10, and is the storeroom of the hive, in which the bees place their surplus honey. Often several supers are placed on one hive.

These supers may be used for either comb or extracted honey, and are each fitted out differently with inside fixtures, the extracting supers having frames similar to those of the brood chamber, only much shallower. These are also used in the sectional brood chamber hive described on page 429. The section box super is provided with section holders or forms to hold the delicate section boxes.

Figure 8. Shallow extracting super. (After the A. I. Root Co.)

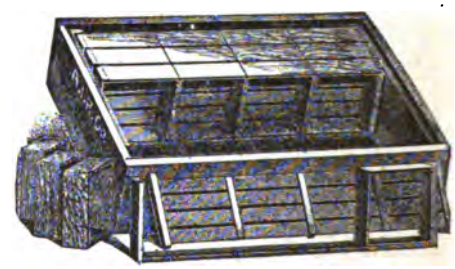


Figure 9. Plain section super. (After the A. I. Root Co.)

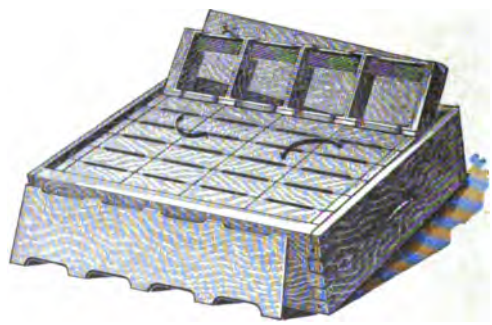


Figure 10. Slotted section super. (After the A. I. Root Co.)

The slotted section super is the oldest and there are probably more of them in use at present among beekeepers than any other, but they are slowly being discarded for those of later design. One important point in the construction of a super is simplicity. The more parts there are, the more time it takes to keep them cleaned of propolis, a gummy substance that the bees use to cover cracks in the hive. This must all be scraped off each time a super is

emptied so that the parts will go together again. The super most highly recommended by the writer is what is known as the N. section frame super, shown in figure 7.

This super, as the name implies, is fitted with eight section frames holding four section boxes each with the ten-frame hive, or seven with the eight-frame hive. The frames are separated by fences, as is shown in the illustration above. These frames not only serve to hold the section boxes square, but by covering them completely protect them from stains and propolis that are always present when the open top styles are used.

THE FRAME.

The frame most commonly used with these hives is what is known as the Hoffman self-spacing, shown in figure 11. This is built in two sizes, one being 9 1-8 inches deep for the regular hive; the other 5 3-8 inches deep for the shallow hive or super. These are suspended separately so that the beekeeper may be able to take a hive of bees entirely apart if he desires. The person who has a modern hive and does not avail himself of the advantages it permits may as well go back to the old box hive of his grandfather.

Figure 11. The Hoffman frame. (After the A. I. Root Co.)

THE SECTIONAL BROOD CHAMBER HIVE.

Another hive highly recommended by the author, especially in the production of comb honey, is what is called the sectional brood chamber hive, shown in figure 12. This is built up with two or more units of extracting supers, such as are used with the Standard in the production of liquid honey. This hive is especially adapted to localities like our own, where the honey flow is of short duration

and rapid work in the super is required. It also makes an ideal brood chamber for wintering. The opening between the two sets of frames forms a passage for the bees to pass, during extreme cold weather, to get to fresh winter stores, without going over, under, or around the combs through the cold extremities of the hive; supers and brood chamber units are interchangeable; colonies are easier and better kept under control during the swarming season; it is easy to make increase when desired simply by removing one unit and supplying it with a queen; and a strong colony is always ready for the super when desired by simply removing all but one unit of the brood chamber. Beekeepers often ask, "How can I get my bees to work in the super?" The sectional hive solves the problem. It puts the honey in the super. Yes, all the honey.

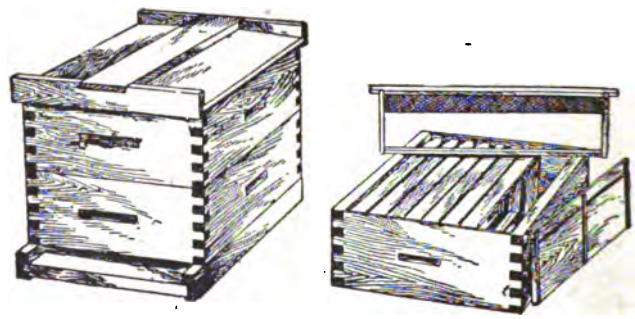


Figure 12. Sectional brood chamber hive. (After W. T. Falconer Mfg. Co.)

A queen excluder (see figure 13) should always be used between the brood chamber and super of this hive; otherwise the queen in her restricted quarters would go above to lay and it is desirable to keep brood and surplus honey separated. This hive might be termed a specialist's hive but it can be easily managed by an amateur. Both of the above hives are built in two sizes, for eight or ten frames. The ten-frame size is the one most commonly used by experienced beekeepers so that it is safe to decide that this is the best adapted for all purposes.

The beginner will make no mistake in selecting either of the hives or supers described above. The amateur who keeps only a few hives will readily decide to work for comb honey, because this will not require an expensive extractor and nice white combs of section honey will appeal to him. For this purpose the sectional

hive is worthy of consideration. All hives or parts should be alike so as to be interchangeable. There probably is no worse nuisance in an apiary than several different styles and shapes of hives and supers.

Smokers.

The smoker (see figure 14) is indispensable while handling bees. It is made of tin or copper and is provided with a bellows to drive the smoke and keep the fire going. Old cotton rags, waste or rotten wood are used for fuel. Blow a little smoke in at the entrance before opening the hive. Give the bees a little more while uncovering the frames; if very cross, repeat the dose, until they yield; then they may be handled safely. Handle them gently, avoiding all quick motions.

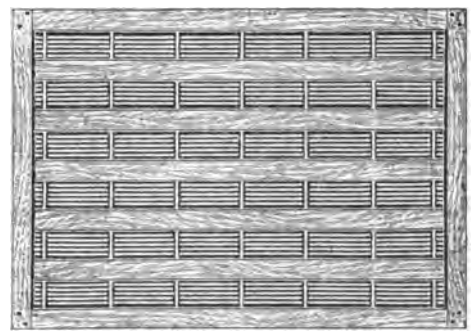


Figure 13. Wood-and-wire queen-excluding board, with seven-wire strips. (After the A. I. Root Co.)

Figure 14. Junior Smoker. (After the A. I. Root Co.)

Figure 15. Bee-glove with fingers. (After the A. I. Root Co.)

Figure 16. The Alexander bee veil. (After the A. I. Root Co.)

Veils.

In addition to the smoker, a veil is necessary for the beginner, and possibly gloves for the hands. It is foolish for the novice to undertake to handle bees without proper protection. One type of veil is shown in figure 16 and a glove in figure 15.

Hive Tool.

Some kind of a hive tool is a necessity. The one illustrated in figure 17 is excellent, though a screwdriver will do.

Comb Foundation.

The comb foundation is a thin sheet of pure beeswax, shown in figure 18, embossed to imitate the base or septum of the natural built comb. The use of this is almost indispensable in securing straight worker brood combs. For economy some beekeepers use only starters, which are narrow strips about one inch wide. This results in the building by the bees of a considerable amount of undesirable drone comb. Later, when this is occupied by the queen, sometimes multitudes of useless drones emerge, which are consumers instead of producers. Three workers or producers can be hatched from the same comb surface that is occupied by two drone cells; therefore it is evident that the full sheets of foundation are cheapest in the end. The use of full sheets is further demonstrated when it is remembered that it takes from fifteen to twenty pounds of honey to produce one pound of wax, and the comb must be built before it can be used for storing honey or brood.

Figure 17. Nickeled-steel hive-tool. (After the A. I. Root Co.)

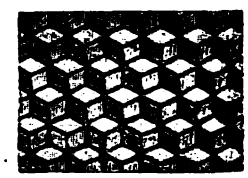


Figure 18. Comb foundation. (After the A. I. Root Co.)

Stocking with Bees.

After getting the hive ready, the next thing is to have it stocked with bees. As a general rule it is best, if possible, to buy good-sized first swarms as they issue during early May. These can usually be procured locally for about three dollars. One great advantage in securing bees in this way is the freedom of any danger of brood diseases which might be found in a colony with combs. Brood diseases are dangerous for the veteran beekeeper but much more so for the beginner. Such a colony hived in a single-story standard hive will soon fill it with honey and brood and a super should be furnished so that all surplus may be stored; likewise with the sectional hive, a single unit is used and a super of section boxes is put on immediately with the excluder between. It is possible and even probable that this may be followed with another one week later, if the honey flow continues. A second unit of brood chamber, however, should be added in sufficient time for the bees to stock it up for winter.

If swarms cannot be obtained in this way it is best to purchase from some reliable dealer. These may be obtained either in bulk, in nucleus, or in full colonies. Full colonies will sometimes produce enough the first season to pay for themselves, so that this usually is a very satisfactory way to buy, and the purchaser will have gentle, blooded stock to start with.

The Colony.

Every normal colony of bees in prosperous times is composed of three varieties of bees: the queen, or, more correctly speaking, the mother bee, that lays all the eggs (often as many as three thousand a day during the busy season); forty or fifty thousand

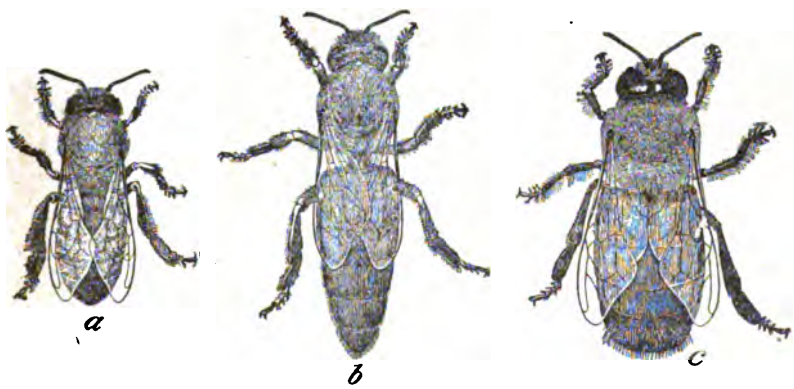


Figure 19. The honey bee: *a*, worker; *b*, queen; *c*, drone. Twice natural size. (After Phillips, Bureau of Entomology, U. S. Department of Agriculture.)

workers or undeveloped females; and a few hundred drones or male bees. The queen is the important factor in the success of the colony. Ancient writers called her the "King," and it was only within a few years that the error was discovered. Some queens are so prolific that the ordinary hive is too small to accommodate them, keeping it overflowing with bees and activity, while others are so inferior that their colonies make only a sickly effort to exist. The drone, queen and worker are shown in figure 19.

As has been mentioned, the combs are composed of two different sized cells. Eggs laid in the larger or drone cells always mature drones, while those laid in the smaller ones mature workers. The

queen cell is simply an elongated worker cell, resembling a peanut, drawn out over the comb. In case the colony needs a queen, any worker egg laid or placed in one of these cells will hatch into a larva, which will be lavishly fed with a thick, milky fluid and mature a queen. The queen usually passes the time of her greatest usefulness in her second year. For this reason a good many progressive beekeepers practice requeening at this time. Eggs are shown on plate XXXVI, c, and drone, queen and worker cells on plate XXXV, b.

Workers.

By far the most numerous bees in the hive are the workers. They are also the smallest, measuring only about one-half inch in length. Except laying the eggs, they do all the work about the hive—gathering the honey and pollen; building the combs; feeding and taking care of the brood; cleaning the hive, sealing all cracks and doing all other labor required. The life of the workers during the busy season is only about six weeks, in which time they wear out their wings flying against the wind or through the grass in the fields in search of food. For this reason grass should always be kept down in front of the hive entrance.

Drones.

The drones are the non-producers of the hive and live on the toil of the workers. They have no means of producing honey or secreting wax or doing even the work necessary for their own support. They are longer than the workers, shorter than the queen, but thicker and clumsier than either. Their wings reach to the tip of their body; and when they are on the wing they make much more noise. Their sole object is to mate with the young queens, which always happens on the wing. After the mating the drone dies immediately.

Races of Bees.

The black or German bee was the first brought to this country, some say by the Pilgrims; others, by way of Florida. These are a very hardy race and good honey gatherers, more especially adapted to the production of comb honey, but their irritable temper and inability to resist disease have brought them into disfavor.

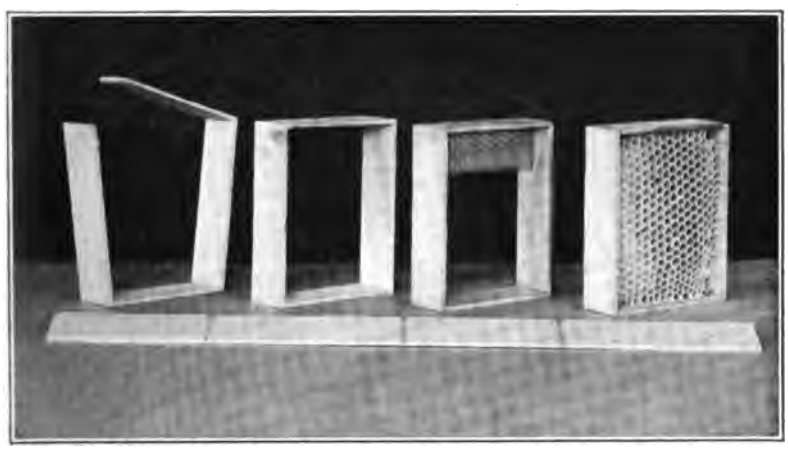
Their cousins, the Banats, Carniolans and Caucasians, three other dark races, are gentle and good honey producers if they can

a. Mating and queen rearing apiary of A. W. Yates, Hartford.

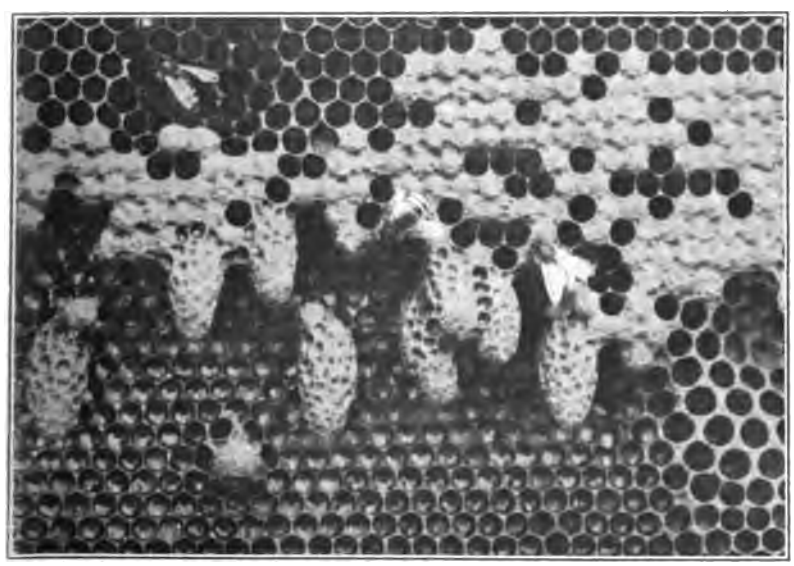
b. View of apiary at Station farm, Mt. Carmel.

PLATE XXXIV.

A standard hive opened showing brood frames: Mr. L. C. Root, Stamford, a veteran Connecticut beekeeper. (After Dr. E. F. Bigelow, Arcadia, Sound Beach, Conn.)



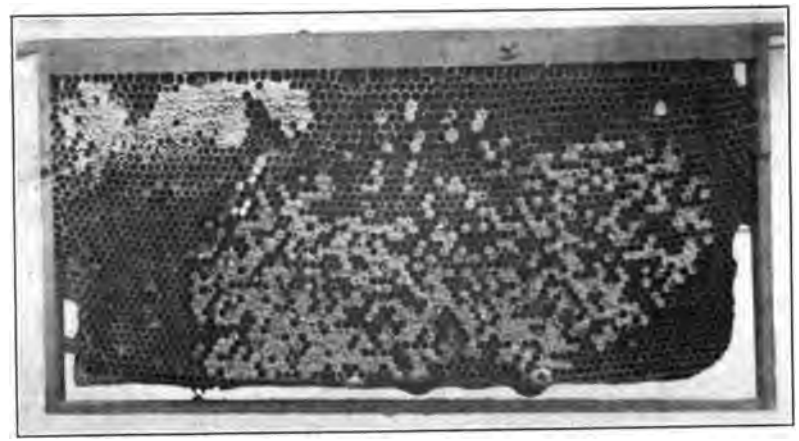
a. Section frames as used in the supers: in the flat, bent together, with foundation starter, and with drawn comb ready to receive the honey.



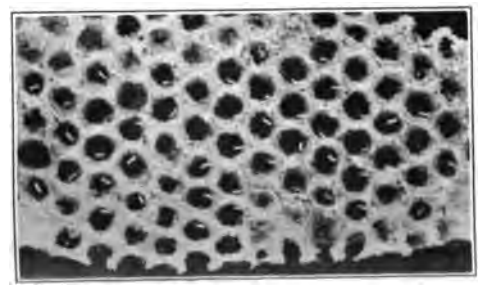
b. Close view of brood comb, showing open and capped cells: the large peanut-shaped cells are queen cells; the larger open cells near lower right hand corner are drone cells; others are worker cells. (After Dr. E. F. Bigelow, Arcadia, Sound Beach, Conn.)

PLATE XXXVI.

a. A swarm just hived.



b. A frame of American foul brood.



c. View through the glass of an observation hive, showing eggs in cells.

be kept from swarming, but this is almost impossible. The Cyprians are energetic workers but also have bad tempers, which bar them from most apiaries.

The Italians, introduced into this country in the sixties, are the most popular among good beekeepers. They are good workers, and, as a rule, are as gentle to handle as any of the other races named. These qualities, together with their rich, golden color, and their ability to withstand some of the worst ravages of foul brood, make them the favorites of our beekeepers.

Location.

The needs of the bees are seldom considered in selecting a location. It is best to choose a sheltered spot, protected as much as possible from prevailing winds. The south side of a hedge, a high board fence or building, or a clearing in the woods, is good. Look out for air currents, such as circulate between two buildings. Have the hives face the south as near as convenient.

Swarm Control.

It requires a large force of bees in each hive to secure a crop of honey. The larger the force when the flow arrives, the better. The beekeeper with one hundred weak colonies would get scarcely any surplus, while the one with only twenty-five or fifty colonies of good strength would obtain good results. This crowded condition, however, is one of the primary causes of swarming, and it is advisable, as far as possible, to have no swarming during the honey flow. Some of the precautions taken for its prevention are the introduction of young queens some time previously; giving plenty of room by adding a super, and when this is partially full, if the prospects look good for the continuance of the flow, inserting another beneath the first; ventilating by giving full, wide entrance, or if the nights are very warm, raising the hive an inch from the bottom board. These methods, while precautionary to discourage swarming, are not preventive and it is advisable to examine every colony occasionally for symptoms, and if at any time it is found that queen cells are started, they should be cut out and a super of extracting combs given without the excluder. A week later, if no cells are started, this can be exchanged for a comb honey super. Should cells be started, however, remove the super, taking the

queen with it, and exchange places with the brood chamber, using this as a brood chamber. Put on a super of section boxes immediately and close the hive. A portion of the bees in the old brood chamber should then be shaken in front of the new hive, leaving only enough to properly take care of the brood, or, if no increase is desired, all should be shaken out and the brood disposed of among weak colonies. This old chamber of brood and some bees having queen cells under way will soon mature a queen and later become as good as any colony.

Comb Honey.

Much more labor and skill is required in the production of comb honey than in extracted honey. In a great many locations some form of contraction is necessary to secure good work in the super. This is true of our own locality and sometimes it is almost impossible to get the bees to go to work in the supers. To remove some of the frames and replace them with wooden dummies invariably results in poor filling of the outside sections and getting them completed with the rest. For this reason all deep frame hives, if not failures, at least are clumsy. It will be seen, then, that it is better to contract from the top, retaining in this way the whole supering surface. With the sectional hive, removing all but one unit reduces the capacity of the brood chamber to the desired amount. This the queen will keep filled with brood, forcing the honey into the super. This single unit, holding the equivalent of about six and one quarter regular frames, is sufficient to maintain the strength of the colony during the main honey flow, after which another unit should be given for the bees to build up for winter. Obviously it takes but a moment's time with this hive to provide a very large brood nest or to contract to a very small one. Units should never be taken away, however, without giving their equivalent in supers, unless a swarm is desired.

Usually during fruit bloom most colonies will require more room. One unit of brood chamber filled with full sheets of foundation is given. This will be drawn out and occupied with honey and brood at the beginning of the clover flow. This is the unit, with its bright, new combs, that should be used when the brood chamber is reduced to one unit. Fancy, white comb honey would become more or less travel-stained if old brood combs were used

here. The excluder and super of section boxes are added and when this is about half filled another is inserted between. More are added as long as there is a prospect of their being finished, so that sometimes there are four or five on at once. Finished section honey should be removed from the bees as soon as completed. It sometimes takes but a few days to become soiled.

As stated previously, with the regular depth frame, bees are sometimes slow to enter the super, because of insufficient numbers or because of three or four inches of capped honey along the top bar of the brood frame, or because the honey flow is not plentiful enough. One or two sections of foundation should be removed and replaced with some that are partly drawn. These are called "Bait sections" and will generally bring about the desired result, and when the bees have once commenced to work in them there will be no further trouble.

Extracted Honey.

To produce extracted honey also requires a large force of bees in each hive. Weak colonies should be built up or united in advance so that all will be at full strength when the flow arrives. Either of the above hives can be used with supers the same size as the brood chambers or with shallow extracting supers. The shallow ones will probably be found the most satisfactory. After the combs are built, nine frames should be used in a ten-frame, or seven in an eight-frame hive. This results in thick, fat combs that are more easily uncapped. The excluder should be used.

When to Put on Supers.

To produce fancy comb honey, full sheets of thin or extra thin foundation should be used in the section boxes. These should be prepared and the supers ready in advance so that there will be no delay when they are needed. This will be about the middle of May if the season should be early and plenty of fruit bloom near by, or the first to the middle of June for clover. A good rule is to put on supers, either for comb or extracted honey when the combs begin to show white along the top bar and the brood nest appears crowded with bees.

The Extractor.

This is a machine with a revolving frame inside, used to remove the honey from the combs, and shown in figure 20. After the honey has thus been removed the combs are returned to the bees to be refilled. It is obvious that this is a great saving to the bees both in time and labor, which is very important during a rapid honey flow, and is the reason why liquid or extracted honey, as it is called, can be bought so much cheaper. An extractor is a good investment for a beekeeper with five or more colonies of bees. In setting the extractor it should be securely fastened in place and raised enough from the floor so that a pail will go under the gate.

Figure 20. Novice non-reversible extractor. (After the A. I. Root Co.)

When the frames of honey are removed from the hive, they are taken into the extracting room, or some room that bees cannot enter and the cappings are cut off with a sharp knife (See figure 21). They are then put into the extractor, and after the honey has been removed from one side they are turned around and it is taken from the other.

Figure 21. Improved Bingham honey-knife. (After the A. I. Root Co.)

After the combs have been emptied, if the flow is over they should be stacked over one or more colonies, to be cleaned of what honey remains. This should be done at night so that they will be finished before daylight—when there is danger of robbers. At the end of the season all extracting combs should be put away secure from rats and mice. One mouse alone will do an immense amount of damage if allowed access to them. For protection from the wax moth, which sometimes makes its appearance, a few camphor balls can be used in each stack of combs.

Care of Extracted Honey.

Liquid honey as it is removed from the extractor should be strained into a deep tank and allowed to stand and settle for a

day or two. This allows small particles of wax to rise to the surface to be skimmed off. It is then bottled or put into cans as desired.

Honey and Its Uses.

Honey is made from a very thin nectar gathered from the flowers by the bees, and carried into their hives. It is so thin that sometimes it takes over two pounds of nectar to make one pound of honey. Different flowers produce different flavors and colors, as, for example, the very light and mild-flavored honey from linden or sweet clover, and the dark and strong-flavored honey from buckwheat.

The chemical analysis of honey shows that it is practically all invert sugar, though small proportions of fruit sugar and sucrose are present. Granulation occurs quickly in some honeys and takes place only after long keeping in others. Nearly all honeys granulate at the approach of cold weather and granulation is an indication of purity rather than of adulteration.

Honey is an excellent food, being almost pre-digested, and is especially recommended for children, invalids and consumptives. The common belief that honey, unlike sugar, can be used safely by diabetics seems not to be supported by facts.

Bakers have found that cookies and cakes, when sweetened with honey, will keep moist and palatable for a long time, and as it is in a sense a preservative, they will not mold. For this reason it is used in canning fruits, immense quantities of the cheaper grades being employed. It is used extensively by biscuit manufacturers and confectioners, one firm alone buying hundreds of tons each year.

For cooking recipes requiring honey, the reader should consult Farmers' Bulletin No. 653, U. S. Department of Agriculture, Washington, D. C.

Honey Plants.

Some of the principal honey and pollen plants of Connecticut, mentioned in about the order in which they commence to yield, are as follows:

Skunk cabbage, willow and elm trees, March and April. These are valuable for early pollen but furnish little nectar.

Maples; April, pollen and nectar.

Dandelion; May 10, pollen and some nectar.

Fruit bloom; May 15, pollen and nectar; when weather conditions are favorable, sometimes surplus honey.

Wild raspberry; June, pollen; nectar makes exceptionally fine table honey and usually yields plentifully.

Locust; May and June; some kinds yield heavily; honey light and of good flavor.

Clover; June 15. The clovers are the most important class of honey plants and include the common white, red, alsike, crimson and sweet clover. Alfalfa, although of the same family, secretes no nectar in this State. White and alsike are by far the most important and in some years produce large quantities of the finest table honey, which is recognized by its light golden color and delicate flavor.

Sweet clover; June until frost. This plant is not duly appreciated by our farmers, so is not sufficiently abundant in Connecticut to be an important honey plant. The honey is light colored, with a pleasant, spicy flavor, making it a delicious table honey. This plant is an exceptionally good forage plant, usually found growing in waste places or where the soil is too poor for other crops. Like the other clovers it requires lime for abundant growth, and when grown under favorable conditions can be cut two or three times a season. The hay is of fine quality, and is relished by horses and cattle.

Red clover; June. Secretes nectar abundantly, but on account of its corolla tubes being too long for honey bees it is more of a bumblebee plant. However, in times of drouth or in case of second growth when the tubes are shorter, it is sometimes worked extensively by honey bees.

Linden or basswood; July. This tree is seldom sufficiently abundant to become an important source of honey. The honey is very light and of fine flavor.

Sumac; July. Some kinds yield nectar freely. The honey is light and of fine flavor.

Goldenrod; September to frost. Honey is light, of good flavor when well ripened.

Wild aster; October till frost. Honey light and of good flavor, but granulates quickly.

Diseases of Bees.

Bees, like all other living things, are subject to diseases, the most common of which in Connecticut are the contagious bacterial brood diseases known as American and European foul brood. The latter is by far the most prevalent, having been found in every county and in some cases wiping out whole apiaries. These diseases, however, if taken in time, can be controlled, but if neglected are sure to cause loss and be a source of infection to surrounding apiaries. For this reason it is imperative that beekeepers should become acquainted with the appearance of these diseases and the methods of treatment so as to handle them intelligently. European foul brood, although much more contagious and rapid in spreading, responds better to treatment than the American foul brood. Dr. Phillips of the Bureau of Entomology at Washington describes the two diseases as follows:

"The presence of a particular disease in a colony of bees can be ascertained most reliably by a bacteriological examination, since the symptoms are somewhat variable. It is possible, however, to describe the usual manifestations of the diseases, and the usual differences, so that the beekeeper can in most cases tell which disease is present.

American Foul Brood.

"American foul brood is frequently called simply 'foul brood.' It usually shows itself in the larva just about the time that the larva fills the cell and after it has ceased feeding and has begun pupation. At this time it is sealed over in the comb. The first indication of the infection is a slight brownish discoloration and the loss of the well-rounded appearance of the normal larva. At this stage the disease is not usually recognized by the beekeeper. The larva gradually sinks down in the cell and becomes darker in color and the posterior end lies against the bottom of the cell. Frequently the segmentation of the larva is clearly marked. By the time it has partially dried down and has become quite dark brown (coffee colored) the most typical characteristic of this disease manifests itself. If a match stick or toothpick is inserted into the decaying mass and withdrawn the larval remains adhere to it and are drawn out in a thread which sometimes extends for several inches before breaking. This ropiness is the chief characteristic used by the beekeeper in diagnosing this disease. The larva continues to dry down and gradually loses its ropiness until it finally becomes merely a scale on the lower side wall and base of the cell. The scale formed by the dried-down larva adheres tightly to the cell and can be removed with difficulty from the cell wall. The scales can best be observed when the comb is held with the top inclined toward the observer so that a bright light strikes the lower side wall. A very characteristic

and usually penetrating odor is often noticeable in the decaying larvae. This can perhaps best be likened to the odor of heated glue.

"The majority of the larvae which die of this disease are attacked after being sealed in the cells. The cappings are often entirely removed by the bees, but when they are left they usually become sunken and frequently perforated. As the healthy brood emerges the comb shows the scattered sunken cappings covering dead larvae, giving it a characteristic appearance.

"Pupae also may die of this disease, in which case they, too, dry down, become ropy, and have the characteristic odor and color. The tongue frequently adheres to the upper side wall and often remains there even

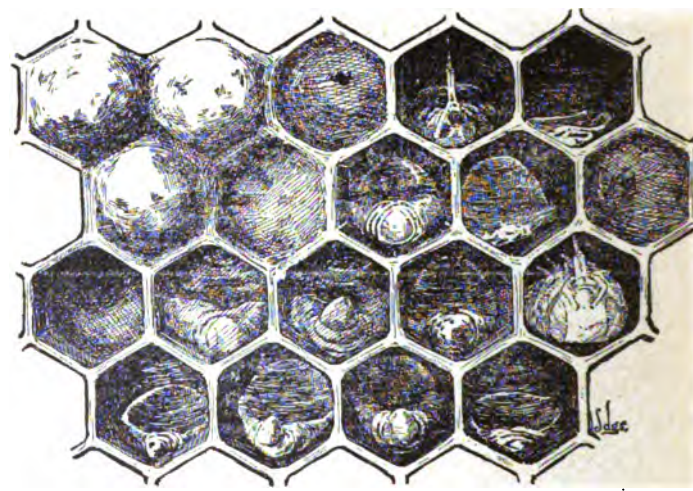


Figure 22. American foul brood: note the normal sealed cells; the sunken cappings, some showing perforations; the larvae and pupae affected by disease; the scales formed from dried-down larvae. Three times natural size. (After Phillips, Bureau of Entomology, U. S. Department of Agriculture.)

after the pupa has dried down to a scale. Younger unsealed larvae are sometimes affected. Usually the disease attacks only worker brood, but occasional cases are found in which queen and drone brood are diseased. It is not certain that race of bees, season, or climate have any affect on the virulence of this disease, except that in warmer climates, where the breeding season is prolonged, the rapidity of devastation is more marked. See figure 22.

European Foul Brood.

"European foul brood was formerly called 'black brood' or 'New York bee disease.' The name 'black brood' was a poor one, for the color of the dead brood is rarely black or even very dark brown. European foul brood usually attacks the larva at an earlier stage of its development than

American foul brood and while it is still curled up at the base of the cell. A small percentage of larvae dies after capping, but sometimes quite young larvae are attacked. Sunken and perforated cappings are sometimes observed just as in American foul brood. The earliest indication of the disease is a slight yellow or gray discoloration and uneasy movement of the larva in the cell. The larva loses its well-rounded, opaque appearance and becomes slightly translucent, so that the tracheae may become prominent, giving the larvae a clearly segmented appearance. The larva is usually flattened against the base of the cell, but may turn so that the ends of the larva are to the rear of the cell, or may fall away from the base. Later the color changes to a decided yellow or gray and the translucency is lost. The yellow color may be taken as the chief characteristic of this

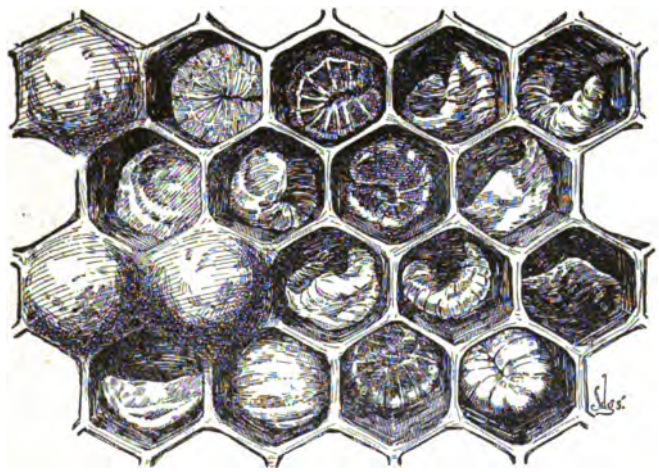


Figure 23. European foul brood: note the normal sealed cells; the larvae affected by disease; the normal larva at age attacked by disease; the dried-down larvae or scales. Three times natural size. (After Phillips, Bureau of Entomology, U. S. Department of Agriculture.)

disease. The dead larva appears as a moist, somewhat collapsed mass, giving the appearance of being melted. When the remains have become almost dry, the tracheae sometimes become conspicuous again, this time by retaining their shape, while the rest of the body content dries around them. Finally all that is left of the larva is a grayish-brown scale against the base of the cell, or a shapeless mass on the lower side wall if the larva did not retain its normal position. Very few scales are black. The scales are not adhesive, but are easily removed, and the bees carry out a great many in their efforts to clean house.

"Decaying larvae which have died of this disease are usually not ropy as in American foul brood, but a slight ropiness is sometimes observed. There is usually little odor in European foul brood, but sometimes a sour

odor is present, which reminds one of yeast fermentation. This disease attacks drone and queen larvae almost as quickly as those of the workers.

"European foul brood is more destructive during the spring and early summer than at other times, often entirely disappearing during late summer and autumn, or during a heavy honey flow. Italian bees seem to be better able to resist the ravages of this disease than any other race. The disease at times spreads with startling rapidity and is most destructive. Where it is prevalent a considerably larger percentage of colonies is affected than is usual for American foul brood. This disease is very variable in its symptoms and other manifestations and is often a puzzle to the beekeeper." See figure 23.

To the ordinary beekeeper the two diseases appear very much alike. "The sunken and perforated cappings, the reduction of the larva to a stringy, brown mass, the foul odor, and the dwindling of the colony, are the most noticeable indications of the foul brood diseases."

How Foul Brood Diseases are Spread.

Some of the means of spreading the infection are as follows:

By the bees:

1. Diseased bees entering wrong hives.
2. Robbing diseased colonies.
3. Eating honey that is infected.

By the owner:

4. Shifting combs from diseased colonies to healthy ones.
5. Using second-hand hives that have contained diseased colonies.
6. Promiscuous handling of healthy and diseased colonies without disinfecting hands and tools.
7. Exchanging places of colonies in diseased apiaries.

Treatment.

As it has been found that Italian bees are more immune to, or at least better able to resist the ravages of, European Foul Brood than other races, it is strongly recommended that apiaries be requeened with young Italian queens of good stock in either of the treatments given below. In the case of all weak colonies, or those showing 25 per cent. or more of diseased brood, it is best to shake the bees if in frame hives, or drum them out if in box hives, into new or disinfected hives containing full sheets of foundation. Good results are sometimes obtained where the colony is VERY

STRONG and the infection is SLIGHT, or less than above stated, by removing the old queen and introducing a young one of good Italian stock ten days later. This results in the cessation of egg-laying for several days, allowing the colony a chance to clean up the decayed matter. The dequeening method should not be used in the treatment of American Foul Brood, which can best be cured only by the shaking method. When treating by the shaking method, it is best to select a time when there is *some honey coming in*, as there is less danger of robbing and the colony will require no further feeding.

If, however, it is decided to treat immediately, and there is no honey coming in, it should be done towards night when few bees are flying, so as to avoid infecting other colonies. For this reason care should be taken not to spill or drop any honey where bees will have access to it. If no honey is coming in, feed a pint of sugar sirup each night for a week or until the bees are nicely started. Never use honey for feeding if it can be avoided.

Disinfection.

All tools, as well as the hands, should be washed thoroughly and the inside of the hive scorched with fire. A plumber's torch is best for this purpose but the hive can be moistened with kerosene oil and lighted, and when sufficiently scorched the fire can be extinguished with a blanket thrown over the hive. The combs should be melted into wax and the refuse burned or buried, and not left where bees can visit it.

Apiary Inspection in Connecticut.

Since 1909 apiaries in Connecticut have been inspected for foul brood diseases, as provided by Statute, the supervision of the work being in charge of the State Entomologist. Two inspectors are employed on a *per diem* basis, as follows: Mr. H. W. Coley, Westport, Inspector for Fairfield, New Haven, Middlesex and New London Counties; Mr. A. W. Yates, Hartford, Inspector for Litchfield, Hartford, Tolland and Windham Counties. Permanent records of these inspections are kept in the office of the State Entomologist at New Haven, and accounts of each season's work have been published in the Reports of this Station as follows:

1910, page 669; 1911, page 275; 1912, page 223; 1913, page 195; 1914, page 126; 1915, page 95; 1916, page 78; 1917, page 242.

Applications for inspection, or for advice about handling bees, may be made to either of the inspectors named above, or to W. E. Britton, State Entomologist, Agricultural Experiment Station, New Haven, Conn.

Publications on Beekeeping.

The following publications will prove useful to those who desire further information on apiculture.

BOOKS.

How to Keep Bees, by Anna Botsford Comstock. Doubleday, Page & Co., Garden City, N. Y., 1905. $1.00.

Beekeeping, by E. F. Phillips. The MacMillan Co., New York, N. Y., 1915. $2.00.

Productive Bee-Keeping, by Frank C. Pellett, J. B. Lippincott Co., Philadelphia, Pa., 1916. $1.50.

A B C and X Y Z of Bee Culture, by A. I. and E. R. Root. The A. I. Root Co., Medina, O., Revised Edition, 1913, $2.50.

BULLETINS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

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Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 206 FEBRUARY, 1918

Being the Report on Commercial Feeding Stuffs 1917

By E. M. BAILEY

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AND

Reports of Board of Control and Treasurer

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Commercial Feeding Stuffs.

By E. M. Bailey*

Under the Connecticut statutes the term "concentrated commercial feeding stuff" covers practically all feeds excepting hay and straw, whole seeds, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Section 4592 requires that every lot or parcel of concentrated commercial feeding stuff shall bear a statement giving the name and address of the manufacturer or importer, the number of net pounds in the package, the name of the article, and the percentages of protein and fat contained in it. The law forbids the use of any metal in affixing tags.

No registration of feeds or payment of analysis or license fees is required.

The penalty for violation of the statute is not more than $100 fine for the first offense and not more than $200 for each subsequent offense.

The law authorizes this station to take samples from any manufacturer or dealer, in a prescribed manner, and requires the station to analyze annually at least one sample of each brand which it has collected, and to publish these analyses "together with such additional information in relation to the character, composition and use thereof as may be of importance."

INSPECTION OF 1917.

One hundred and two samples of feeds were collected by our agent, Mr. Churchill, during the months of November and

* With the assistance of Messrs. C. E. Shepard, M. A. D'Esopo and H. D. Edmund, Analysts.

December, 1917, and January, 1918. These samples are classified as follows:

Cottonseed Meal	11	Hominy Feed	5
Cottonseed Feed	1	Brewers' Grains	2
Linseed Meal	4	Distillers' Grains	2
Wheat Bran	6	Dried Beet-Pulp	2
Mixed Feed	10	Horse, Dairy and Stock Feed	35
Wheat Middlings	6	Cocoa Shell Meal	1
Rye Feed	3	Poultry Feed	10
Rye Middlings	1		
Corn Oil Cake Meal	1		
Gluten Feed	2	Total	102

Miscellaneous feeds, fifty-two in number, have been sent in by private individuals and by the Dairy Commissioner.

One hundred and twenty-one complete fodder analyses were made in connection with field experiments of the Storrs Station.

One hundred and forty-three such analyses in connection with field experiments of this Station were also made.

Seven hundred samples of shelled corn were examined for nitrogen or moisture or both. These are in connection with plant breeding experiments.

A total of 1,118 samples of fodder materials have had complete or partial analyses.

Only the regular fodder inspection and miscellaneous feeds sent by private individuals will be discussed here. Other results are connected with investigations which will be discussed elsewhere.

THE ROLE OF THE NUTRIENTS.

The law of this State requires a statement of the amount of protein and fat only in any feed, but for the intelligent preparation of a ration other nutrient constituents should be known. Numerous authoritative works* on the nutrition of animals discuss the

* **Henry and Morrison,** Feeds and Feeding. Henry and Morrison, Madison, Wis. **Jordan, W. H.,** The Feeding of Animals. The MacMillan Co., New York. **Armsby, H. P.,** The Principles of Animal Nutrition. John Wiley & Son, New York.

functions of the several constituents at much length, but it will not be amiss to briefly restate here the part played by these constituents in the digestive process.

Water. Air dry feeding stuffs, whether concentrates or roughage, still contain some moisture which cannot be seen or felt. The amount of such moisture averages not far from ten or twelve per cent. While not a nutrient in the ordinary sense, water is essential to the animal, but since it is obtained in abundance from sources other than the feed, its presence therein is not of importance. Excessive amounts, however, jeopardize the keeping qualities of a feed and automatically reduce the percentage of the more desirable ingredients.

Ash. The mineral constituents of feeds are contained in the ash. Their importance is far greater than has been generally supposed and can be appreciated from the fact that animals fed on rations deprived so far as possible of all ash constituents, generally die sooner than animals given no food at all. That lime, iron, phosphorus, potassium, sodium, chlorine and other mineral substances, all of which are contained in the ash of vegetable materials, are essential to the animal body, is shown by the conspicuous presence of one or more of them in all the vital tissues and secretions. Just how they act is not completely understood, but one of their functions is undoubtedly to stimulate those cell activities (enzymic processes) which are at the foundation of both animal and vegetable life.

Protein. This is the name of a group of nitrogen-containing substances essential to the life of the animal body. They repair body waste, build up new body tissue, and, to a lesser extent, furnish heat and energy. It was long supposed that all the group of proteins could perform all these functions. But investigations of recent years, particularly those which have been carried on in the research laboratory of this Station, have shown that such is not the case; that while one protein can both repair and build, another can repair only. The one not only suffices to maintain the body against its own wear and tear, but causes it to grow and develop naturally; the other suffices only to prevent decline. Hence the important distinction has been made between complete and incomplete proteins. This is enough to suggest that, in addition to the standard of digestibility by which we now

differentiate between proteins, we shall eventually judge them by the more critical standard of specific service rendered. It further suggests the wisdom, not only of supplying a sufficient quota of protein in the ration of an animal, but of supplying it from different sources so that those elements which are deficient or lacking in one may be supplied by another. In other words, a mixed ration is as desirable for the lower animals as for human beings.

Crude Fibre. By this term is meant the coarser and more woody tissue characteristic of all forms of roughage and present on the outer coats of cereal grains. Such material is in part digested by ruminants but its chief value lies in its mechanical effect in the intestinal tract.

Nitrogen-free Extract. Here are included those substances termed carbohydrates which embrace nutrients of the starch and sugar types. Their principal part in nutrition is to supply heat and energy, but they have also the power of sparing protein, by which is meant that when fed together with protein they reduce the amount of the latter food required. An excess of these foods over the immediate needs of the body can be transformed into fat and stored in the body tissue.

Ether Extract (Crude Fat). Fats, like the carbohydrates furnish energy to the body and like them also, but to a lesser extent, spare protein. As energy producers their value is 2.25 times greater than that of either carbohydrate or protein. This ether-soluble material is in all cases crude fat, by which we understand that non-fatty substances like chlorophyll and coloring matter may be included therein.

Table 1 shows the digestion coefficients, or percentages of the food elements of the more commonly used feeds which are digestible by neat cattle (Feeds and Feeding, by Henry and Morrison, 1915, page 647 et seq.).

Some of these figures are the result of only a very few tests, and all of them represent short periods of feeding and must be regarded as showing comparative digestibility of the feeds only very roughly. Like chemical composition, a statement of the digestibility of a feed is only a single "pointer" to the feeder, helpful, if it is not over-valued.

TABLE I. DIGESTION COEFFICIENTS.

	Protein	Fiber	Carbohydrates	Fat
Cotton Seed Meal	84	37	75	95
Linseed Meal (old process)	89	57	78	89
Wheat Bran	76	43	74	62
Wheat Feed	77	36	76	87
Wheat Middlings	77	30	78	88
Red Dog Flour	88	36	88	86
Corn Gluten Meal	85	55	90	93
Corn Gluten Feed	85	76	88	85
Hominy Feed	66	76	90	91
Dried Brewers' Grains	81	87	80	85
Malt Sprouts	77	87	80	85
Dried Distillers' Grains	73	95	81	95
Dried Beet Pulp	52	83	83	..
Wheat Bran and Corn Cob Feed	63	28	71	92

NUTRITIVE RATIO.

Nutritive ratio is a term with which many dairymen are, and all should be, familiar. The nutritive ratio of a given feed means the ratio between the digestible protein and the amount of digestible carbohydrates (or nitrogen-free extract and fiber) and crude fat (or ether extract) which that feed contains. We have already noted above that protein and carbohydrates have the same energy producing value, and that fat has 2.25 times as much, hence in calculating a nutritive ratio, fat must be first resolved to the same energy basis as carbohydrate which is done by multiplying by the factor 2.25.

Taking as an example, cottonseed meal containing 35.43 per cent of protein, 12.28 per cent of fiber, 32.37 per cent of nitrogen-free extract and 6.50 per cent of fat, the first step is to determine the amount of the several nutrients which are digestible. Referring to the list of coefficients of digestibility, Table I, it is seen that these coefficients for cottonseed meal are protein 84, fiber 37, carbohydrates 75 and fat 95. Multiplying the above percentages by these factors respectively, we find to be digestible 29.8 per cent. of protein, 4.5 per cent fiber, 24.2 per cent nitrogen-free extract, and 6.2 per cent fat. Reducing the digestible fat to the energy equivalent basis of the carbohydrates, we obtain 14.0. The total digestible carbohydrate from nitrogen-free extract and

fiber is 29.8+4.5=34.3, to which is added the fat 14.=48.3. The nutritive ratio can now be stated, and is carbohydrate+fat, 48.3: protein, 29.8 or $\frac{48.3}{29.8}$ =1.6. The nutritive ratio is therefore 1:1.6. In this way the nutritive ratio of any feed for which coefficients of digestibility have been determined, may be calculated.

COMMENT ON ANALYSES.

(The anaylses are tabulated on pages 466 to 477.)

Cottonseed Meal. This product is recognized by the Association of Feed Control Officials and generally in the trade as a product of the cotton-seed only, composed principally of the kernel with such portion of the hull as is necessary in the manufacture of oil; provided that nothing shall be recognized as cottonseed meal that does not conform to the foregoing definition and that does not contain at least 36 per cent of protein.

There are three classes of meals, viz.: *Choice, Prime* and *Good.*

Choice cottonseed meal must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and must contain at least 41 per cent of protein.

Prime cottonseed meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, yellow, not brown or reddish, free from excess of lint, and must contain at least 38.6 per cent of protein.

Good cottonseed meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color, and must contain at least 36 per cent of protein.

The cottonseed meals examined this year, eleven in number, averaged 35.43 per cent protein, 12.28 per cent fiber, 32.27 per cent nitrogen-free extract, and 6.50 per cent fat. The average price per ton was $57.55. As compared with this product last year the protein content is 2.30 per cent and the fat content 0.15 per cent lower, while the price is $10.60 per ton higher. The average guaranteed amounts of protein and fat were 36.46 per cent and 5.05 per cent respectively, from which it is seen that these feeds as a class fail to meet their guaranty as to protein by 1.03 per cent, and exceed the declared amount of fat by 1.50

per cent. The amount of crude fiber found is a trifle lower than last year, but considerably in excess of amounts found during the six years previous.

Samples which failed to meet their guaranties by 1 per cent or more of protein were one sample of the Buckeye brand; one sample marked Second Class, one sample each of Danish, Pilgrim and Puritan brands.

The brand selling for the highest price, viz.:—$63.00, contained the highest per cent of protein, and was well above guaranty in other respects; but another brand selling for $62.00 was the lowest but one of all samples in content of protein.

Cottonseed Feed is a mixture of cottonseed meal and cottonseed hulls, containing less than 36 per cent of protein.

This class of feeds will become largely recruited from the ranks of those now classed as cottonseed meal if the downward tendency in quality of the latter, as noted in the last few years, continues.

Only one sample of this class was examined this year, and this was in substantial accord with its guaranty.

Linseed Meal is the ground product obtained after extraction of part of the oil from ground flaxseed screened and cleaned of weed seeds and other foreign materials by the most improved commercial processes. Old Process meal is that from which the oil is removed by hydraulic pressure. In the New Process the oil is removed by the use of solvents.

Four samples were examined this year. The average composition was substantially the same as last year. Two equalled or exceeded the guaranteed amount of protein, the others falling less than 1 per cent below. Guaranties of fat were exceeded in all cases. The average price $59.50 is $11.64 higher than the average last year.

Wheat Bran is the coarse outer coating of the wheat berry obtained in the usual commercial milling process from wheat that has been cleaned and scoured.

Wheat Bran with Screenings not Exceeding Mill Run is either wheat bran with the whole mill run of screenings or wheat bran with a portion of the mill run of screenings, provided that such portion is not an inferior portion thereof.

The six samples examined contained an average of 15.13 per cent of protein, 4.99 per cent of fat. One sample bore no statement of guaranty. The others exceeded their guaranties in all cases. The price per ton has advanced $7.70 over the average shown a year ago.

Wheat Mixed Feed is a mixture of the products other than the flour obtained from the milling of the wheat berry.

Ten samples of this class of feeds, averaged 15.88 per cent protein and 5.13 per cent of fat. All exceeded their guaranties in fat, and also, with one exception, in protein. The one deficiency in protein was less than 1 per cent. The average of all ingredients was nearly the same as last year but the price per ton shows an advance of about $12.00.

Wheat Middlings may be *Standard Middlings* (Shorts), which are the fine particles of the outer and inner bran separated from bran and white middlings, or they may be *White Middlings* which are that part of the offal of wheat intermediate between shorts or standard middlings and red dog.

The samples examined exceeded their guaranties as to protein and fat with one exception, in which a deficiency of less than 1 per cent protein was found. As regards price, the maximum last year is the minimum now. There is also a wide variation in price, three brands selling for $44 to $46, and three others for $50 to $68 per ton. The average advance over the prices of a year ago is $14.38 per ton.

Rye Feed and *Rye Middlings* are by-products from the rye grain corresponding to those defined under similar terms for wheat by-products.

Of rye products, three rye feeds and one rye middlings were examined. All exceeded their guaranties in both protein and fat. Variations in price per ton were not so wide as in the case of wheat products but an advance of about 25 per cent over last year's figures is shown.

Corn Gluten Feed is that portion of commercial shelled corn that remains after the separation of the larger part of the starch and the germ by the process employed in the manufacture of cornstarch and glucose.

Only two samples of this class were analyzed. Globe exceeded its guaranty in both protein and fat. Buffalo was found deficient

in fat to the extent of 0.56 per cent. These products, which sold for $40 to $43 last year, are $55 to $58 per ton now.

Hominy Feed (*Hominy Chop, Hominy Meal*) is a mixture of the bran coating, the germ and a part of the starchy portion of the corn kernel obtained in the manufacture of hominy grit for human consumption.

Five samples of hominy feed averaged 11.52 per cent protein and 7.00 per cent fat, exceeding their guaranties in all cases. The average price per ton advanced from $45.00 last year to $64.00 now. Prices vary from $45.00 to $75.00. The brand selling for $45.00 has the same amount of protein and nearly the same amount of fat, with other constituents about the same as the brand selling for 66.6 per cent higher.

Oil Cake Meal is obtained by grinding the press cake left after partial removal of oil from the corn germ.* The analysis of the single sample examined appears in Table VI.

Brewers' Grains are the properly dried residue from cereals obtained in the manufacture of beer. They consist chiefly of barley but may contain whatever other cereals were used in conjunction therewith.

The two samples examined satisfied their guaranties except for a negligible deficiency in protein in one case. The composition remains uniform with that shown by previous inspections. The price has advanced during the year from an average of $31.00 to $55.00.

Distillers' Grains are the dried residue from cereals obtained in the manufacture of alcohol and distilled liquors. The product shall bear the designation indicating the cereal predominating.

Two samples were examined. One satisfied the guaranties as to protein and fat within reasonable limits, but contained more than the guaranteed maximum of crude fiber. The other exceeded the guaranteed amount of protein, but was deficient in fat. Last year seven samples of this class ranged in price from $30.00 to $43.00 per ton. One of the brands this year sold for $62.00.

Dried Beet Pulp is the dried residue obtained in the manufacture of beet sugar.* Two samples of this product satisfied their guaranties. Prices last year ranged from $33.00 to $37.00 per ton. The selling price this year was $46.00 and $52.00.

* Not an A. F. C. O. definition.

Proprietary Mixed Feeds are not products of definite composition. They are an outlet for various by-products and their ingredients will be governed by what is available to the manufacturer to put into them. Besides cereal grains and by-products thereof they may also contain screenings, cereal hulls and other fillers. Salt and saccharine substances such as molasses or corn syrup are also added in some cases.

Many brands bear on the tags, in addition to the chemical guaranty, a statement of the ingredients used. Information of this character, not required by law in this State, is given by the manufacturers of the following brands:

Pennant Stock Feed. Fine white hominy and oat by-products, ½ of 1 per cent of salt.

Bufceco Chop Feed. Ground corn, oats, barley, hominy feed, oat shorts and oat hulls.

Bufceco Steam Cooked Feed. Ground corn, oats, hominy feed, oat shorts, oat middlings, oat hulls and ½ of 1 per cent salt.

Bufceco Horse Feed. Ground oats, corn, barley, wheat middlings, hominy feed, oat shorts, oat middlings, oat hulls, linseed meal, corn gluten feed.

Wirthmore Stock Feed. Ground barley, ground oats, ground hominy meal, ground corn, oatmeal by products, ½ of 1 per cent salt. Part of the ingredients have been cooked or steamed, and are more easily assimilated and have better keeping qualities.

Economic Horse and Mule Feed. Distillers' and yeast grains from corn, rye, barley malt and sprouts, linseed meal, cottonseed meal, brewers' grains from barley, wheat bran, humus, salt, molasses and corn.

H & S Horse, Mule and Dairy Feed. Flaxseed meal, old process oil meal, alfalfa meal, brewers' and rye distillers' grains, pure cane syrup, ½ of 1 per cent salt.

Larro-feed. Cottonseed meal, corn gluten feed, distillers' grains (mainly from corn), dried beet pulp, standard wheat bran, standard wheat middlings, ¾ of 1 per cent salt. Wheat bran and middlings may contain "ground screenings not exceeding mill run."

Peerless Horse Feed, Corn, oats, alfalfa meal, molasses.

King Corn Horse and Mule Feed. Corn, oats, alfalfa and molasses.

Emerald Horse Feed. Cracked corn, oats, barley, alfalfa meal and molasses.

Union Grains. Fowrex distillers' grains, choice cottonseed meal, old process linseed meal, white wheat middlings, wheat bran, hominy meal, gluten feed, brewers' grains, malt sprouts, ½ of 1 per cent salt.

Bufceco Poultry Mash. Ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat middlings and rolled oats.

Thirty-five brands of this class of feeds were examined. Of these ten failed to meet their guaranties either in protein or fat or both. Deficiencies up to 1 per cent in protein and 0.25 per cent in fat have been disregarded. The deficient brands are as follows:

TABLE II. PROPRIETARY FEEDS BELOW GUARANTY.

No.	Brand	Protein Deficiency%	Fat Deficiency%
9792	Unicorn Dairy Ration	1.81	....
9856	Big Clover Complete Ration	....	0.42
9784	Economic Horse and Mule Feed	3.94	1.19
9821	Horse, Mule and Dairy Feed	....	1.11
9803	Badger Stock Feed	1.37	....
9781	Peerless Horse Feed	....	0.47
9770	Big Q Dairy Ration	2.00	....
9867	Purina Calf Chow Feed	....	0.55
9826	Ryde's Cream Calf Meal	....	1.37
9819	Biles Ready Ration	....	0.46

While our law requires guaranties of protein and fat only, other guaranties, if made, should be correct. In thirteen brands the maximum of crude fiber was declared and in three instances this maximum was exceeded by more than 1 per cent. Thus **9808,** Bufceco, **9781,** Peerless, and **9785,** Emerald, Horse Feeds, contained excess fiber to the extent of 2.31, 2.10 and 4.56 per cent respectively.

Our experience has shown that those proprietary feeds which contain molasses or other added saccharine substance may fail to receive credit for their full amount of crude fat by the official method of extraction. Following our practice of the last few

years, such feeds have been treated first with water to remove sugary materials before the ether extraction was made. The modified method does not give uniformly higher results, but does, we believe, give results closer to the truth.

The following summary shows our experience this year.

TABLE III. FAT IN MOLASSES FEEDS.

No.	Brand	Official Method%	Modified Method%	Guaranty %
9784	Economic Horse and Mule Feed	3.81	3.74	5.00
9821	Horse, Mule and Dairy (Hamlin's)	1.38	2.39	3.50
9858	Atlas Horse Feed.....	0.93	2.46	1.00
9857	Monogram Feed.....	1.86	3.01	3.00
9781	Peerless Horse Feed.....	1.51	1.53	2.00
9785	Emerald Horse Feed.....	1.24	1.97	2.00
9867	Purina Calf Chow Feed.....	3.45	2.60	4.00
9861	Good Luck Feed.....	2.66	2.73	1.50

The prices which prevail for these goods are very high; disproportionate in many instances to the feeding value of the product. Taking the protein content as an index to the feeding value, it is evident that price bears no rational relation to quality. One brand containing the lowest amount of protein, 8.63 per cent, sold for $47.00. Others containing only from 9 to 11.7 per cent protein sold for from $60 to $71.00. Again high protein feeds containing 24 to 24.5 per cent sold for $80 to $90.00. Another containing more of this nutrient, viz. 24.88 per cent, sold for $58.00.

Unusual trade conditions at the present time are naturally reflected in the feed market, and it is idle to discuss prices for they change during such discussion. With the abnormally high prices prevailing for all human food stuffs the price of milk to the consumer is steadily increasing. A glance at the price column in the tables on these pages will convince us that the real problem is not how the dairyman can produce milk profitably, but, rather, how he can produce it at all.

Poultry Feeds. In this class of products, as in the stock feeds, one looks in vain for any relation between price and quality. One brand with 50 per cent protein sells for $82.00 and another with only 19 per cent sells for only $5.00 less. Platco Laying Mash fell below its protein guaranty by 1.68 per cent. Purina Chicken Chowder and Chick Chuck were deficient in fat.

MISCELLANEOUS SAMPLES.

Partial or complete analyses have been made of the following samples, taken and submitted by individuals.

Cottonseed Meal. **10525, 9752, 9753, 9101,** brands or manufacturers not known; **8836,** Rugg Murdock, Boston; **8835,** Humphreys-Godwin Co., Memphis, Tenn.; **9018,** J. E. Soper Co., Boston; **9019,** Meridian Grain & Elevator Co., Meridian, Miss.; **8770,** National Feed Co., St. Louis, Mo., all sent by Coles Co., Middletown.

9999, bought for imported, sent by Herold's Lanedale Farm, New Canaan.

8806, 8807, American Red Tag Meal, Union Seed & Fertilizer Co., New York; **8763,** Forfat Brand, Humphreys-Godwin Co., Memphis, Tenn.; **8764,** Danish Brand, Humphreys-Godwin Co., Memphis, Tenn., sent by S. J. Orr, West Suffield.

TABLE IV—PROTEIN IN COTTONSEED MEALS.

No.	Found %	Guaranteed %	No.	Found %	Guaranteed %	No.	Found %	Guaranteed %
10525	35.38	36.00	8835	35.56	....	8806	37.81	....
9752	35.44	....	9019	36.94	....	8807	36.50	....
9753	37.94	....	9018	35.69	....	8763	38.31	38.55
9101	36.88	....	8770	35.50	38.50	8764	34.75	36.00
8836	36.81	....	9999	28.56	....			

Wheat Bran—**9599,** Holstein Feed. (Under stock price). Wheat bran with screenings, sent by J. B. Brainard, Bloomfield, contained 10.69 per cent protein. Guaranty, 12 per cent.

Wheat Middlings. **9758,** Washburn-Crosby, sent by L. A. Bevan, contained 15.94 per cent protein.

Corn Meal, **9748,** sent by J. B. Stetson, contained 9.25 per cent protein.

9142, bought for corn meal, sent by G. B. Dimon, Chestnut Hill. This was a coarse feed consisting of corn and wheat products with oat hulls and bran coats. It contained 16.88 per cent of protein.

Gluten Feed. **8960,** KKK Corn Gluten Feed. J. C. Hubinger Bros. Co., Keokuk, Iowa, sent by D. W. Ives, E. Wallingford, contained 24.56 per cent of protein. Guaranty 23 per cent or more.

8884, Buffalo Gluten Feed, sent by Jewett City Grain Co., contained 23.88 per cent protein.

Proprietary Stock Feeds. **8741,** Crosby's Ready Ration, sent by Seymour Grain Buyers' Club, C. R. Newton, Agt., contained 23.88 per cent protein. Guaranty 25 per cent.

9338, Dairy Feed, sent by A. B. Wakeman, Fairfield, contained 20.06 per cent protein.

Poultry Feeds. **9249,** Protox Poultry Food, Fine, American Agricultural Chemical Co., New York, sent by F. M. Peasley, Cheshire, contained 53.13 per cent protein and 5.99 per cent phosphoric acid. Guaranty 55 per cent protein.

8954, Meat Scrap, the L. T. Frisbie Co., New Haven, sent by C. A. Stone, Oakville, contained 41.75 per cent protein.

8955, Meat Scrap, The Conn. Fat Rendering and Fertilizer Co., New Haven, sent by C. A. Stone, Oakville, contained 42.13 per cent protein.

Miscellaneous Feeds. **9760,** Toasted Milk Nuts, sold by J. E. Bartlett, Jackson, Michigan, and sent by C. M. Jarvis, Berlin. The product contained 8.90 per cent water, 1.25 per cent ash, 14.19 per cent protein, 7.91 per cent crude fiber, 66.21 per cent nitrogen-free extract, and 1.54 per cent crude fat. The significance of the name is not apparent to us from any information we have concerning it, and we have no data by which to judge its digestibility. Judging from the analysis the gross supply of nutrient is satisfactory and, if palatable, should be a desirable feed. The price for this product was $30.00 per ton.

9709, Corn Oil Meal, car heated, The Meader-Atlas Co., New York, sent by C. M. Jarvis, Berlin, contained 21.44 per cent protein.

9712, Peanut "Skins" sent by H. H. Worthington of New Milford. This was composed of the thin brown red coat or skin which covers the edible portion of the peanut. Small fragments of peanut were present which accounts in part for the considerable amount of fat found. The sample contained 6.50 per cent water, 2.33 per cent ash, 14.88 per cent protein, 10.12 per cent fiber, 44.43 per cent nitrogen-free extract and 21.74 per cent fat. The bitter taste of these skins is a familiar fact, and their palatability

to animals will decide their use as a fodder. The analysis shows that the sample contains very considerable amounts of nutrient material.

9248, Cracker Waste, Loose Wiles Biscuit Co., sent by C. M. Jarvis, Berlin, contained 6.19 per cent protein.

9401, Damaged Wheat; **9537,** Beans (seconds); **9536,** Damaged Oats, all sent by C. M. Jarvis, Berlin, were analyzed as follows:

	9401	9537	9536
Water	11.20%	15.83%	9.30%
Ash	2.56	3.50	3.95
Protein	11.88	21.75	11.88
Fiber	2.95	3.07	9.60
Nitrogen-free extract	68.57	54.96	60.04
Fat	2.84	0.89	5.23

9547, Grain Siftings, waste, sent by John E. Gifford, County Agent, Rockville. This was found to contain 13.50 per cent of protein, equivalent to 2.16 per cent of nitrogen. It also contained 0.88 per cent total phosphoric acid and 1.24 per cent total potash with 17.44 per cent total ash and 10.33 per cent ash insoluble in acid.

8860, Peanut Meal; **8869,** Damaged Corn (burned); **9411,** Alfalfa Ground Feed; **8870,** Rye and Oats, all sent by C. M. Jarvis, Berlin, were analyzed as follows:

	8860	8869	9411	8870
Water	8.06%	7.75%	14.34%	6.45%
Ash	5.42	1.73	3.95	2.69
Protein	36.56	11.44	15.13	12.38
Fiber	8.15	8.59	13.45	6.76
Nitrogen free extract	35.06	66.35	50.16	68.53
Fat	6.75	4.14	2.97	3.19

Sample 8869 was corn that had been damaged by burning and a considerable part of the "fiber" shown above is charcoal.

8758, Waste Flour, Franco-American Baking Co., sent by Frank N. Platt, Milford, contained 11.06 per cent protein.

9061, Corn and Bean Silage, sent by Karl B. Musser, Storrs, contained, as received, 43.74 per cent water, 1.68 per cent ash, 3.37 per cent protein, 6.84 per cent fiber, 2.01 per cent

crude fat (ether extract), and 12.36 per cent nitrogen-free extract.

A sample of Condensed Buttermilk **10637**, made by the Consolidated Products Co., Lincoln, Neb., and a sample of Dried Buttermilk **10684** obtained from Hales and Edwards Company, Chicago, Ill., were sent to us by C. M. Jarvis of Berlin.

The composition of these products is shown by the following analyses:

	10637		10684	
	As Analyzed %	Dry Basis %	As Analyzed %	Dry Basis %
Moisture	76.97	00.00	8.27	00.00
Solids	23.03	100.00	91.73	100.00
Ash	2.94	12.77	12.15	13.24
Protein	9.57	41.55	31.07	33.87
Milk Sugar	6.98	30.31	34.34	37.43
Fat	2.78	12.07	7.24	7.89
Undetermined	0.76	3.30	6.93	7.57
Calories per lb	413.0	1,794.0	1,480.0	1,614.0
Nutritive ratio	1:1.4	....	1:1.6	....

Reduced to the dry basis, it is seen that these materials are closely alike, the difference being within the range of normal variations in the composition of buttermilk. The ash consists largely of phosphates of lime and common salt. They are abundantly nutritious and are reported to have been used with success as a feed for pigs. The dried product is more economical to transport, and possesses the added advantage of superior keeping qualities.

The following feeds were submitted by the Dairy Commissioner for examination with reference to their conformity to guaranty.

TABLE V—FEEDS SAMPLED BY THE DAIRY COMMISSIONER.

No.	Brand, Manufacturer or Jobber	Protein Guaranteed %	Protein Found %
	Cottonseed Meal.		
9697	Not given	.....	36.13
11905	Puritan, J. E. Soper Co., Boston	36.00	34.13
11722	American Red Tag, Union Seed & Fer. Co., N. Y.	38.55	37.56
11718	American Red Tag, Union Seed & Fer. Co., N. Y.	38.55	38.75
11717	Puritan, J. E. Soper Co., Boston	36.00	31.44
11716	No. 7, Union Seed & Fertilizer Co., New York	36.00	35.50
11715	National Feed Co., St. Louis, Mo.	38.50	35.00

No.	Brand, Manufacturer or Jobber	Protein Guaranteed %	Protein Found %
	Brewers' Grains.		
11871	Not given	30.00	28.13
	Proprietary Feeds.		
11714	Portage Stock Feed, Ak. Feed & Mill Co., Akron, O.	8.00	8.88
11720	Anchor Dairy Feed, Globe Elevator Co., Buffalo, N. Y.	16.00	13.50
11719	Bonnie Horse Feed, Holmes, Keeler & Kent Co.	13.00	14.13

TABLE VI.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cotton Seed Meal.	
9844	Buckeye. Buckeye Cotton Oil Co., Cincinnati, O.	*Middlefield:* Middlefield Grain & Coal Co.
		Guaranty
9854	Buckeye. Buckeye Cotton Oil Co., Cincinnati, O.	*Hartford:* Loydon, Northam & Loydon
		Guaranty
9849	Second Class. Byromville Oil Co., Byromville, Ga.	*Hazardville:* A. D. Bridges Sons
		Guaranty
9851	Danish. Humphreys, Godwin Co., Memphis, Tenn	*Hartford:* Olds & Whipple
		Guaranty
9779	Danish. Humphreys, Godwin Co., Memphis, Tenn	*Wallingford:* E. E. Hall
		Guaranty
9817	Danish. Humphreys, Godwin Co., Memphis, Tenn	*Yantic:* A. R. Manning
		Guaranty
9864	Forfat. Humphreys, Goodwin Co., Memphis, Tenn	*New Haven:* Crittenden-Benham Co
		Guaranty
9815	Puritan. J. E. Soper Co., Boston, Mass.	*New London:* P. Schwartz Co
		Guaranty
9835†	Pilgrim. J. E. Soper Co., Boston, Mass.	*Meriden:* August Grulich
		Guaranty
9840	Puritan. J. E. Soper Co., Boston, Mass.	*Colchester:* M. Klingon
		Guaranty
9793	Surety. Union Seed & Fert'z'r. Co., Clarksdale, Miss	*Guilford:* Morse & Landon
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Cotton Seed Feed.	
9774	77. Humphreys, Godwin Co., Memphis, Tenn.	*North Haven:* Co-operative Feed Co
		Guaranty
	Linseed Meal, Old Process.	
9799†	American Linseed Co., New York	*West Cheshire:* G. W. Thorpe
		Guaranty
9841	American Linseed Co., Buffalo, N. Y.	*Colchester:* M. Klingon
		Guaranty
9810	Archer Daniels Linseed Co., Buffalo, N. Y.	*Derby:* Peterson Hendee Co.
		Guaranty
9778	Kellogg's. Spencer Kellogg, Buffalo, N. Y.	*Wallingford:* E. E. Hall
		Guaranty
		Average guaranty
		Average of anaylses
		Average digestible
	WHEAT PRODUCTS.	
	Wheat Bran.	
9771*	Wm. Hamilton & Son, Honeoye Falls, N. Y.	*North Haven:* Co-operative Feed Co
		Guaranty

* With screenings not exceeding mill run. † Wire tags.

SAMPLED IN 1917.

Station No.	Pounds per Hundred						Price per ton.
	Water.	Ash.	Protein. (N. x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
9844	7.59	5.74	34.94	12.15	33.20	6.38	$58.00
....	....	....	**36.00**	**14.00**	**30.00**	**5.00**	....
9854	6.84	6.38	35.38	11.86	33.22	6.32	61.00
....	....	....	**36.00**	**14.00**	**30.00**	**5.00**	....
9849	7.94	5.38	34.19	13.54	32.08	6.87	62.00
....	....	....	**36.00**	....	....	....	....
9851	8.15	5.42	31.44	14.84	33.50	6.65	53.00
....	....	....	**36.00**	**15.00**	**25.00**	**5.00**	....
9779	7.65	5.49	35.56	10.84	33.97	6.49	55.00
....	....	....	**36.00**	**15.00**	**25.00**	**5.00**	....
9817	7.93	5.67	36.13	12.13	32.10	6.04	56.00
....	....	....	**36.00**	**15.00**	**25.00**	**5.00**	....
9864	7.75	6.22	39.69	10.17	29.46	6.71	63.00
....	....	....	**38.55**	**12.00**	**25.00**	**5.00**	....
9815	6.41	7.17	35.94	13.10	30.62	6.76	55.00
....	....	....	**36.00**	**15.00**	**30.00**	**5.00**	....
9835	6.93	5.66	36.31	13.00	31.69	6.41	58.00
....	....	....	**38.50**	**10.00**	....	**5.00**	....
9840	8.44	5.28	34.75	11.36	34.12	6.05	58.00
....	....	....	**36.00**	**15.00**	**30.00**	**5.00**	....
9793	8.30	6.31	35.44	12.11	30.94	6.90	54.00
....	....	....	**36.00**	**14.00**	**27.00**	**5.50**	....
....	....	....	**36.46**	....	....	**5.05**[1]	....
....	**7.63**	**5.88**	**35.43**	**12.28**	**32.27**	**6.50**	**57.55**
....	....	....	**29.8**	**4.5**	**24.2**	**6.2**	....
9774	9.16	4.37	19.63	22.73	40.10	4.01	40.00
....	....	....	**20.00**	**28.00**	....	**4.00**	....
9799	10.01	5.31	33.81	7.52	37.08	6.27	60.00
....	....	....	**34.00**	**8.00**	....	**5.00**	....
9841	9.55	5.15	35.31	6.93	36.67	6.39	58.00
....	....	....	**34.00**	....	....	**5.00**	....
9810	9.89	5.29	32.13	6.96	36.66	9.07	64.00
....	....	....	**33.00**	....	....	**6.00**	....
9778	9.77	5.13	33.69	5.61	39.70	6.10	56.00
....	....	....	**33.00**	....	....	**5.00**	....
....	....	....	**33.50**	....	....	**5.25**	....
....	**9.81**	**5.22**	**33.73**	**6.75**	**37.53**	**6.96**	**59.50**
....	....	....	**30.0**	**3.9**	**29.3**	**6.2**	....
9771	9.38	5.43	14.81	8.11	58.20	4.07	45.00
....	....	....	**11.75**	**10.60**	....	**2.15**	....

[1] Ten analyses.

TABLE VI.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Continued.*	
	Wheat Bran—Continued.	
9865*	Pittsford Milling Co., Pittsford, N. Y.	*New Haven:* Crittenden-Benham Co.
		Guaranty
9782	Korno. St. Paul Mill Co., St. Paul Minn.	*Wallingford:* E. E. Hall
		Guaranty
9805	Angelus. Thompson Milling Co., Lockport, N. Y.	*Ansonia:* Ansonia Flour & Grain Co.
		Guaranty
9802*	Washburn, Crosby's. Washburn Mills, Minneapolis, Minn.	*West Cheshire:* G. W. Thrope
		Guaranty
9776*	Black Hawk. Western Flour Mill Co., Davenport, Iowa	*Wallingford:* E. E. Hall
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Feed (Mixed Feed)	
9816	Bailey Fancy. E. W. Bailey & Co., Montpelier, Vt.	*Yantic:* A. R. Manning
		Guaranty
9811	Bulls Eye. Blish Milling Co., Seymour, Ind.	*Derby:* Peterson Hendee Co.
		Guaranty
9777**	Boston. Duluth Superior Mill. Co., Duluth, Minn.	*Wallingford:* E. E. Hall
		Guaranty
9795	Improved Grafton. Grafton Roller Mills, Grafton, No. Dak.	*Middletown:* Meech & Stoddard, Inc.
		Guaranty
9859	Improved Grafton. Grafton Roller Mills, Grafton, No. Dak.	*Waterbury:* Spencer Grain Co., Inc.
		Guaranty
9822	Pennant. National Mill. Co., Toledo, O.	*Norwich:* Chas. Slosberg
		Guaranty
9852	Occident. Russell Miller Mill. Co, Minneapolis, Minn.	*Hartford:* G. M. White
		Guaranty
9809A	Gold Mine. Shefield King Mill. Co., Minneapolis, Minn.	*Shelton:* Ansonia Flour & Grain Co.
		Guaranty
9825	Waggoner-Gates Mill. Co., Independence, Mo.	*Willimantic:* Willimantic Grain Co.
		Guaranty
9773	Kent, Williams Bros. Co., Kent, O.	*North Haven:* Co-operative Feed Co.
		Guaranty
		Average guaranty
		Average of analyses
		Average digestible
	Wheat Middlings.	
9789*	Hecker-Jones-Jewell Mill. Co., New York	*Bridgeport:* Susman-Feuer Co.
		Guaranty
9842*	Millbourne. Millbourne Mills, Philadelphia, Pa.	*Colchester:* M. Klingon
		Guaranty
9801*	Ogilvie Flour Mill Co., Winnipeg, Canada	*West Cheshire:* G. W. Thorpe
		Guaranty

* With screenings not exceeding mill run. ** With wheat screenings.

SAMPLED IN 1917—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N. x 6.25)	Fiber	Nitrogen-free Extract. (Starch, gum, etc.)	Ether. Extract. (Crude Fat)	
9865	9.93	6.25	14.25	8.96	56.12	4.49	$50.00
....	....	....	....	....	....	....	....
9782	9.45	5.91	14.94	8.56	55.90	5.24	38.00
....	....	....	14.00	....	....	4.00	....
9805	8.80	5.61	15.88	10.21	53.66	5.84	42.00
....	....	....	15.00	....	....	4.00	....
9802	8.84	6.15	14.69	13.43	52.52	4.37	42.00
....	....	....	16.25	....	....	4.00	....
9776	8.94	5.62	16.25	10.35	52.90	5.94	38.00
....	....	....	13.30	....	....	3.00	....
....	....	....	14.06[2]	....	....	3.43[2]	....
....	9.22	5.83	15.13	9.93	54.88	4.99	42.50
....	....	....	11.5	4.3	40.6	3.1	....
9816	9.62	6.65	15.38	7.88	55.80	4.67	48.00
....	....	....	15.00	....	....	3.75	....
9811	9.66	5.65	15.25	8.33	56.60	4.51	49.00
....	....	....	16.00	9.10	....	4.40	....
9777	9.17	4.14	17.06	7.76	55.81	6.06	45.00
....	....	....	16.00	....	....	4.50	....
9795	9.36	4.63	16.75	6.88	56.83	5.55	48.00
....	....	....	14.00	....	....	2.70	....
9859	11.28	4.43	15.94	7.69	55.20	5.46	51.00
....	....	....	14.00	....	....	2.70	....
9822	9.09	4.80	15.44	6.01	60.02	4.64	49.00
....	....	....	15.00	....	....	3.75	....
9852	9.42	5.73	15.81	7.41	56.22	5.41	54.00
....	....	....	15.00	....	....	4.50	....
9809A	9.98	5.02	16.38	8.00	54.89	5.73	51.00
....	....	....	15.00	....	....	4.00	....
9825	9.46	5.94	15.63	7.36	56.90	4.71	50.00
....	....	....	15.00	....	....	4.00	....
9773	10.37	4.75	15.19	6.01	59.15	4.53	51.00
....	....	....	12.00	....	....	3.00	....
....	....	....	14.70	....	....	3.73	....
....	9.74	5.17	15.88	7.33	56.74	5.13	49.60
....	....	....	12.2	2.6	43.1	4.5	....
9789	9.49	5.08	16.94	6.97	56.14	5.38	44.00
....	....	....	15.50	8.00	54.67	4.75	....
9842	9.90	4.29	15.38	5.57	59.72	5.14	46.00
....	....	....	16.00	3.00	....	4.00	....
9801	10.15	4.08	15.25	7.72	57.63	5.17	46.00
....	....	....	15.00	....	....	4.00	....

[2] Five anaylses.

TABLE VI.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Concluded*	
	Wheat Middlings—Concluded	
9853	XX Daisy. Pillsbury Co., Minneapolis, Minn..	*Hartford:* G. M. White....
		Guaranty.....
9860	B. Pillsbury Co., Minneapolis, Minn.....	*Waterbury:* Spencer Grain Co., Inc.....
		Guaranty.....
9850	Snowball. Shane Bros. & Wilson Co., Minneapolis, Minn.....	*Hazardville:* A. D. Bridges Sons.....
		Guaranty.....
		Average guaranty.....
		Average of analyses.....
		Average digestible.....
	RYE PRODUCTS.	
9824	Feed. Boutwell Mill. Co., Troy, N. Y.....	*Willimantic:* Willimantic Grain Co.....
		Guaranty.....
9845	Irving Mills Feed. Van Vechten Mill. Co., Rochester, N. Y.....	*Middlefield:* Middlefield Grain & Coal Co.....
		Guaranty.....
9780	Irving Mills Feed. Van Vechten Mill. Co., Rochester, N. Y.....	*Wallingford:* E. E. Hall...
		Guaranty.....
9832	Pure Middlings. Washburn-Crosby Co., Minneapolis, Minn.....	*Wallingford:* Gallagher Bros.
		Guaranty.....
	MAIZE PRODUCTS.	
	Corn Gluten Feed.	
9806	Globe. Corn Products Refining Co., New York.	*Ansonia:* Ansonia Flour & Grain Co.....
		Guaranty.....
9791	Buffalo. Corn Products Refining Co., New York.....	*East Haven:* F. A. Forbes..
		Guaranty.....
		Average analyses.....
		Average digestible.....
	Hominy Feed.	
9823	Spring Garden. Baltimore Pearl Hominy Co., Baltimore, Md.....	*Norwich:* Chas. Slosberg..
		Guaranty.....
9837	Bufceco. Buffalo Cereal Co., Buffalo, N. Y....	*Meriden:* Meriden Grain & Feed Co.....
		Guaranty.....
9848	Badger. Chas. A. Krause Mill. Co., Milwaukee, Mo.....	*Thomsonville:* Geo. S. Phelps & Co.....
		Guaranty.....
9846	Steam Cooked. Miner-Hillard Mill. Co., Wilkes-Barre, Pa.....	*Middlefield:* Middlefield Grain & Coal Co.....
		Guaranty.....
9794	Steam Cooked. Miner Hillard Mill. Co., Wilkes-Barre, Pa.....	*Guilford:* Morse & Landon
		Guaranty.....
		Average guaranty.....
		Average of analyses.....
		Average digestible.....
	Oil Cake Meal.	
9798	Heart of the Corn. Chicago Heights Oil Mfg. Co., Chicago, Ill.....	*Middletown:* Meech & Stoddard, Inc.....
		Guaranty.....

SAMPLED IN 1917—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N. x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
9853	10.60	3.72	18.44	2.72	59.54	4.98	$68.00
....	....	....	**16.00**	....	....	**4.00**	....
9860	10.74	5.08	16.44	8.53	53.82	5.39	50.00
....	....	....	**14.00**	....	....	**4.00**	....
9850	11.07	4.63	17.88	6.08	54.80	5.54	60.00
....	....	....	**15.00**	....	....	**4.50**	....
....	....	....	**15.25**	....	....	**4.21**	....
....	**10.33**	**4.48**	**16.72**	**6.27**	**56.94**	**5.27**	**52.33**
....	....	....	**12.9**	**1.9**	**44.4**	**4.6**	....
9824	9.64	4.02	15.31	3.90	63.56	3.57	50.00
....	....	....	**13.50**	....	....	**3.00**	....
9845	10.90	3.59	15.44	4.04	62.62	3.41	49.00
....	....	....	**12.00**	....	....	**3.00**	....
9780	9.52	3.69	16.50	6.73	59.93	3.63	48.00
....	....	....	**13.00**	**10.00**	....	**2.00**	....
9832	8.93	4.82	17.19	6.21	59.16	3.69	50.00
....	....	....	**14.00**	....	....	**3.00**	....
9806	8.68	4.38	25.50	7.72	51.68	2.04	58.00
....	....	....	**23.00**	....	....	**1.00**	....
9791	9.65	4.36	25.00	8.09	51.46	1.44	55.00
....	....	....	**23.00**	....	....	**2.00**	....
....	....	**9.17**	**25.25**	**7.91**	**51.57**	**1.74**	**56.50**
....	....	....	**21.5**	**6.0**	**45.4**	**1.5**	....
9823	7.83	3.38	11.38	5.26	65.50	6.65	65.00
....	....	....	**10.00**	....	....	**6.00**	....
9837	9.51	3.57	11.44	4.51	63.75	7.22	75.00
....	....	....	**10.00**	**4.00**	....	**6.00**	....
9848	10.82	3.19	11.44	4.42	2.23	7.90	$65.00
....	....	....	**10.00**	....	....	**6.00**	....
9846	8.59	3.01	11.88	4.40	65.65	6.47	70.00
....	....	....	**10.00**	**3.00**	....	**5.00**	....
9794	9.13	2.97	11.44	4.06	65.61	6.79	45.00
....	....	....	**10.00**	**3.00**	....	**5.00**	....
....	....	....	**10.00**	....	....	**5.60**	....
....	**9.18**	**3.22**	**11.52**	**4.53**	**64.55**	**7.00**	**64.00**
....	....	....	**7.6**	**3.4**	**58.1**	**6.4**	....
9798	8.75	3.18	21.88	7.94	50.84	7.41	50.00
....	....	....	....	....	....	....	....

TABLE VI.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	BREWERY AND DISTILLERY PRODUCTS.	
	Brewers' Grains.	
9855	Bull. Farmers Feed Co., New York.....	*Hartford:* Loydon, Northam & Loydon.....
		Guaranty.....
9847	Providence Brewing Co., Providence, R. I.....	*Thompsonville:* Geo. S. Phelps & Co.....
		Guaranty.....
		Average of analyses.....
		Average digestible.....
	Distillers' Grains.	
9804	Atlas. Atlas Feed & Mill. Co., Peoria, Ill.....	*West Cheshire:* G. W. Thorpe
		Guaranty.....
		Digestible.....
9772	Dried grains. The Fleishman Co., Chicago, Ill.	*North Haven:* Co-operative Feed Co.....
		Guaranty.....
		Digestible.....
	MISCELLANEOUS FEEDS.	
9827	Dried Beet Pulp. Holland St. Louis Sugar Co., St. Louis, Mich.....	*Willimantic:* Willimantic Grain Co.....
		Guaranty.....
9868	Dried Beet Pulp. Michigan Sugar Co., Bay City, Mich.....	*New Haven:* R. G. Davis & Son.....
		Guaranty.....
10207	Cocoa Shell Meal: Hershey Chocolate Co.....	*Colchester:* Colchester Farm Produce Co.....
		Guaranty.....
	PROPRIETARY MIXED FEEDS.	
	Horse, Dairy and Stock Feeds.	
9820	Pennant Stock Feed. E. W. Bailey & Co., Swanton, Vt.....	*Norwich:* Chas. Slosberg..
		Guaranty.....
9796	Blatchford's Calf Meal. Blatchford Calf Meal Co., Waukegan, Ill.....	*Middletown:* Meech & Stoddard, Inc.....
		Guaranty.....
9814	Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y.....	*New London:* P. Schwartz Co.....
		Guaranty.....
9812	Bufceco Steam Cooked Feed. Buffalo Cereal Co., Buffalo, N. Y.....	*New London:* P. Schwartz Co.....
		Guaranty.....
9808	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.....	*Shelton:* Ansonia Flour & Grain Co.....
		Guaranty.....
9792	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind.....	*Branford:* S. V. Osborn....
		Guaranty.....
9856	Big Clover Complete Ration. Clover Leaf Mill. Co., Buffalo, N. Y.....	*Hartford:* Loydon, Northam & Loydon.....
		Guaranty.....
9828	Clover Leaf Dairy Feed. Clover Leaf Mill. Co Buffalo, N. Y.....	*Willimantic:* Willimantic Grain Co.. .....
		Guaranty.....
9839	Clover Leaf Calf Meal. Clover Leaf Mill. Co., Buffalo, N. Y.....	*Colchester:* David Shea....
		Guaranty.....

SAMPLED IN 1917—*Continued.*

Station No.	Pounds per Hundred						Price per ton.
	Water.	Ash.	Protein. (N. x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
9855	6.62	3.41	28.44	13.43	41.47	6.63	$60.00
....	....	....	27.00	....	....	6.00	....
9847	6.31	3.29	24.81	14.78	44.03	6.78	50.00
....	....	....	25.00	....	....	5.00	....
....	6.47	3.35	26.63	14.11	42.75	6.71	55.00
....	....	....	21.6	6.9	24.4	6.0	....
9804	6.07	1.86	32.88	12.61	37.43	9.15	62.00
....	....	....	30.00	14.00	30.00	10.00	....
....	....	....	24.0	14.0	30.3	8.7	....
9772	6.49	2.60	18.13	23.66	42.14	6.98	44.00
....	....	....	19.00	19.00	....	7.00	....
....	....	....	13.2	22.5	34.1	6.6	....
9827	9.57	3.17	10.60	18.39	57.65	0.62	52.00
....	....	....	8.00	20.00	58.00	0.50	....
9868	9.62	3.33	8.56	18.06	59.27	1.16	46.00
....	....	....	8.00	20.00	58.00	0.50	....
10207	3.46	2.86	16.25	14.34	51.18	11.91	30.00
....	....	....	14.00	....	....	....	....
9820	8.71	4.38	9.25	10.48	60.55	6.63	$60 00
....	....	....	10.00	10.00	....	6.50	....
9796	9.89	5.47	23.94	8.09	46.19	6.42	88.00
....	....	....	24.00	....	....	5.00	....
9814	8.30	3.88	9.06	10.50	62.23	6.03	60.00
....	....	....	8.00	10.00	68.00	4.00	....
9812	7.06	3.65	9.94	8.58	64.11	6.66	60.00
....	....	....	10.00	8.00	....	4.00	....
9808	8.35	4.13	11.69	10.31	60.67	4.85	71.00
....	....	....	11.00	8.00	60.00	4.00	....
9792	7.88	7.04	24.19	9.81	45.07	6.01	58.00
....	....	....	26.00	....	....	5.50	....
9856	8.72	7.15	23.06	15.81	41.18	4.08	64.00
....	....	....	24.00	....	....	4.50	....
9828	8.34	10.51	13.50	17.84	46.29	3.52	50.00
....	....	....	13.50	....	....	3.00	....
9839	9.57	6.25	22.06	6.95	50.31	4.86	70.00
....	....	....	19.00	....	....	5.00	....

TABLE VI.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.* *Horse, Dairy and Stock Feeds—Continued.*	
9818	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass.	*Yantic:* A. R. Manning.... Guaranty
9784	Economic Horse & Mule Feed. Economic Feed Co., New York	*Milford:* E. L. Oviatt..... Guaranty
9790	Stock Feed. John W. Eshelman, Lancaster, Pa.	*Bridgeport:* Susman-Feuer Co. Guaranty
9821	Horse, Mule and Dairy Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Norwich:* Chas. Slosberg.. Guaranty
9787	Pul Mor Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Bridgeport:* Susman-Feuer Co. Guaranty
9803	Badger Stock Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*West Cheshire:* G. W. Thorpe Guaranty
9833	Dairy Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Meriden:* August Grulich.. Guaranty
9834	Stock Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Meriden:* August Grulich.. Guaranty
9836	Crescent Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Meriden:* August Grulich.. Guaranty
9838	Larro-feed. Larrowe Milling Co., Detroit, Mich.	*Meriden:* Meriden Grain & Feed Co. Guaranty
9858	Atlas Horse Feed. The Meader Atlas Co., New York	*Hartford:* Loydon, Northam & Loydon..... Guaranty
9813	Meadowland Dairy Ration. Metropolitan Mills, New York	*New London:* P. Schwartz Co. Guaranty
9857	Monogram Feed. Metropolitan Mills, New York	*Hartford:* Loydon, Northam & Loydon..... Guaranty
9781	Peerless Horse Feed. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Wallingford:* E. E. Hall... Guaranty
9831	Stevens 44 Dairy Ration. Park & Pollard Co., Boston, Mass.	*Wallingford:* Gallagher Bros. Guaranty
9869	King Corn Horse & Mule Feed. M. C. Peters Mill. Co., Omaha, Neb	*New Haven:* R. G. Davis & Son Guaranty
9809B	King Corn Horse & Mule Feed. M. C. Peters Mill. Co., Omaha, Neb	*Shelton:* Ansonia Flour & ..Grain Co. Guaranty
9785	Emerald Horse Feed. Prairie State Mill. Co., Chicago, Ill	*Bridgeport:* Standard Feed Co. Guaranty
9786	Green Cross Horse Feed. Quaker Oats Co., Chicago, Ill	*Southport:* C. Buckingham & Co. Guaranty
9783	Schumacher's Stock Feed. Quaker Oats Co., Chicago, Ill	*Milford:* E. L. Oviatt.... Guaranty

SAMPLED IN 1917—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N. x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat)	
9818	7.94	3.97	9.94	10.40	60.97	6.78	$60.00
....	....	....	9.00	9.50	60.00	4.00	....
9784	10.01	5.25	14.06	11.53	55.34	3.81	65.00
....	....	....	18.00	16.00	....	5.00	....
9790	8.39	4.28	11.44	9.30	61.55	5.04	70.00
....	....	....	10.00	....	....	3.00	....
9821	8.46	9.36	13.56	15.67	50.56	2.39	58.00
....	....	....	14.00	16.00	58.00	3.50	....
9787	9.47	7.84	10.69	15.71	54.92	1.37	55.00
....	....	....	9.00	....	....	1.00	....
9803	8.40	4.65	8.63	15.97	58.02	4.33	47.00
....	....	....	10.00	....	....	4.50	....
9833	7.19	6.31	24.88	11.16	43.73	6.73	58.00
....	....	....	24.00	....	....	5.00	....
9834	7.39	4.90	9.19	13.17	59.01	6.34	60.00
....	....	....	10.00	....	....	4.00	....
9836	9.25	7.89	10.94	14.97	55.33	1.62	58.00
....	....	....	10.00	....	....	1.00	....
9838	8.54	5.11	20.50	11.82	49.47	4.56	55.00
....	....	....	20.00	14.00	50.00	3.00	....
9858	7.72	8.52	7.31	17.04	56.95	2.46	50.00
....	....	....	8.00	....	....	1.00	....
9813	7.76	5.58	20.69	21.25	39.36	5.36	58.00
....	....	....	18.00	....	....	3.50	....
9857	8.58	6.95	13.13	16.43	51.90	3.01	56.00
....	....	....	14.00	....	....	3.00	....
9781	10.03	7.16	12.06	14.10	55.12	1.53	56.00
....	....	....	10.00	12.00	55.00	2.00	....
9831	7.03	4.87	23.88	13.29	43.38	7.55	58.00
....	....	....	24.00	....	....	5.00	....
9869	9.58	7.98	12.13	16.95	51.92	1.44	58.00
....	....	....	10.00	18.00	50.00	1.50	....
9809B	8.45	5.72	11.94	16.98	55.62	1.29	58.00
....	....	....	10.00	....	....	1.50	....
9785	7.60	7.83	12.56	16.56	53.48	1.97	60.00
....	....	....	10.00	12.00	50.00	2.00	....
9786	9.94	5.10	9.69	13.18	59.26	2.83	57.00
....	....	....	10.00	....	....	2.50	....
9783	8.55	5.65	11.75	11.32	58.46	4.27	60.00
....	....	....	10.00	....	....	3.25	....

TABLE VI.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Concluded.*	
	Horse Dairy and Stock Feeds—Concluded.	
9770	Big Q Dairy Ration. Quaker Oats Co., Chicago, Ill.	*North Haven:* Co-operative Feed Co.
		Guaranty
9775	Schumacher's Calf Meal. The Quaker Oats Co., Chicago, Ill.	*North Haven:* Co-operative Feed Co.
		Guaranty
9867	Purina Calf Chow Feed. Ralston Purina Mills, St. Louis, Mo.	*New Haven:* Crittenden-Benham Co.
		Guaranty
9861	Good Luck Feed. Ralston Purina Mills, St. Louis, Mo.	*So. Norwalk:* S. Roodner.
		Guaranty
9826	Ryde's Cream Calf Meal. Ryde & Co., Chicago, Ill.	*Willimantic:* Willimantic Grain Co.
		Guaranty
9819	Biles Ready Ration. Union Grains. Ubiko Mill. Co., Cincinnati, O.	*Yantic:* A. R. Manning.
		Guaranty
	POULTRY FEEDS.	
9807	Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y.	*Ansonia:* Ansonia Flour & Grain Co.
		Guaranty
9870	Globe Egg Mash. Albert Dickenson Co., Chicago, Ill.	*New Haven:* R. G. Davis & Sons.
		Guaranty
9788	Laying Mash. John W. Eshelman, Lancaster, Pa.	*Bridgeport:* Susman-Feuer Co.
		Guaranty
9800	Blue Ribbon Laying Mash. Globe Elevator Co., Buffalo, N. Y.	*West Cheshire:* G. W. Thorpe
		Guaranty
9707	M. & S. Dry Mash. Meech & Stoddard, Inc., Middletown, Conn.	*Middletown:* Meech & Stoddard, Inc.
		Guaranty
9862	Lay or Bust Dry Mash. Park & Pollard Co., Boston, Mass.	*Norwalk:* C. E. Slauson & Co.
		Guaranty
9863	Growing Feed. Park & Pollard Co., Boston, Mass.	*Norwalk:* C. E. Slauson & Co.
		Guaranty
9829	Platco Laying Mash. Frank S. Platt Co., New Haven, Conn.	*New Haven:* Frank S. Platt Co.
		Guaranty
9866	Purina Chicken Chowder. Ralston Purina Mills, St. Louis, Mo.	*New Haven:* Crittenden-Benham Co.
		Guaranty
9830	Chic Chuck. Russia Cement Co., Gloucester, Mass.	*New Haven:* Frank S. Platt Co.
		Guaranty

SAMPLED IN 1917—*Concluded.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N. x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether. Extract. (Crude Fat)	
9770	8.71	5.26	19.00	10.37	50.71	5.95	$59.00
....	....	....	21.00	10.50	....	6.00	....
9775	7.14	4.14	19.00	1.91	57.02	10.79	80.00
....	....	....	18.00	....	....	8.00	....
9867	10.02	3.59	33.69	3.40	45.85	3.45	94.00
....	....	....	33.00	....	....	4.00	....
9861	10.02	6.20	11.69	5.17	64.19	2.73	58.00
....	....	....	9.00	....	....	1.50	....
9826	10.82	5.85	24.50	7.10	48.10	3.63	90.00
....	....	....	25.00	....	....	5.00	....
9819	7.35	5.60	24.06	10.04	46.41	6.54	62.00
....	....	....	24.00	10.00	50.00	7.00	....
9807	9.11	4.42	16.13	5.62	59.37	5.35	69.00
...	....	....	15.00	5.00	....	4.00	....
9870	10.42	5.37	16.63	7.59	55.28	4.71	72.00
....	....	....	15.00	....	....	3.00	....
9788	8.73	9.61	21.75	6.60	46.48	6.83	75.00
....	....	....	20.00	7.00	....	5.00	....
9800	8.69	6.59	20.88	8.23	50.47	5.14	70.00
....	....	....	20.00	....	....	3.00	....
9707	9.26	8.32	17.63	7.03	52.60	5.16	68.00
....	....	....	12.00	....	....	3.00	....
9862	9.95	12.07	19.81	7.04	46.09	5.04	75.00
....	....	....	18.00	....	....	1.50	....
9863	10.45	6.66	16.06	14.30	48.83	3.70	75.00
....	....	....	10.00	....	....	1.50	....
9829	9.00	14.40	18.63	5.12	46.37	6.48	65.00
....	....	....	20.31	....	....	5.54	....
9866	10.29	7.10	18.75	7.16	53.33	3.37	77.00
....	....	....	18.00	....	....	4.00	....
9830	5.59	39.44	50.63	....	....	1.37	82.00
....	....	....	50.00	....	....	2.00	....

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State of Connecticut

PUBLIC DOCUMENT No. 32

TWENTY-SECOND REPORT

OF THE

DAIRY AND FOOD COMMISSIONER

TO

THE GOVERNOR

FOR FISCAL YEARS ENDING SEPTEMBER 30, 1917-18.

PRINTED IN COMPLIANCE WITH STATUTE

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To His Excellency, MARCUS H. HOLCOMB,
Governor, State of Connecticut:

Sir: In accordance with the provisions of the General Statutes, I herewith have the honor to submit my report for this department for the two fiscal years ended September 30, 1918.

THE DAIRY SITUATION.

The maintenance of any industry as an industry rests on the fundamental economic law that such an industry must be conducted on the basis of costs, plus a reasonable profit. That this principle applies to the dairy industry as well as to all others is of course self-evident, nor can the permanence of the dairy industry be in any other way assured.

During the past few years the European War has had effects both serious and far-reaching upon the production of milk and upon the price asked therefor. That the cost of milk production has increased decidedly in a multitudinous variety of ways, is no theoretical statement, but is based on facts of absolute knowledge, especially when the items of cost of labor and feeds are considered. Even at times it has not been a question of what price to pay for grain, or of what wages to pay to men, but it has been, at times, in some sections, an absolute impossibility to purchase feed or hire men at any price.

The inevitable result of this situation has been an increase in price of milk to the consumer and has consequently brought about a storm of protests and refusals on the part of the consumer, so great as to preclude the possibility of a return for his milk to the producer, at all proportionate to the increased cost of production.

In this connection, milk dealers and distributors have

played a not unimportant role. They, too, have been subjected to larger expenditures, nor have they been slow to support most forcibly any movement resulting in the advance in price to the consumer. Unfortunately, however, some dealers and distributors have been prone to discount the actuality of the condition confronting the farmers, and, for the most part, set themselves in opposition to granting any increase in rate.

This attitude on the part of dealers and distributors toward the cost of milk production went far toward stultifying the average producer's resourcefulness and acumen, and led him sometimes voluntarily, but more often by the sheer force of circumstances, to the production of milk of inferior standards and sanitation, or to decrease the number of cows kept in his herd, or both, in an effort in some way to overcome constantly rising costs. In many instances, producers have been compelled to dispose of their herds entirely and to retire from the dairy industry.

It is inconceivable that such a situation could obtain without imparting its evil influences to the consumer. For the most part the consumer has recognized this situation and adjusted himself thereto, not without complaint, it is true, but, nevertheless, with the realization that to do otherwise would open the way for the menace of a serious milk shortage, wherein it would be no longer a question of getting milk at any price, but rather a question of not getting any milk at all. The effect of such a calamity upon the health and vitality of the public at large, and especially on the part of infants, growing children and invalids, is too obvious to require further discussion. Let it be remembered, however, that in the last analysis, a farmer must be adequately reimbursed for his labor and the conduct of his business. This is a fact that must be reckoned with, and is one that no amount of theoretical argument will overcome.

DAIRY AND STABLE INSPECTIONS.

Dairy and stable inspection work was originally conducted to safeguard the consumer against the production of milk below certain fixed standards and criterions of cleanliness. Its aim was also to coöperate with the producer and indicate to him how to make the purest milk by the adoption of such of the latest accepted methods as were practically applicable to his particular environment.

To be satisfactory, the inspection of dairy farms must be carried on by competent inspectors. They should have a practical, sympathetic knowledge of dairy farm conditions; they should know the essential features in the production and handling of safe and clean milk; and they must be able to distinguish between those factors which make for public health and those having relation to cleanliness or economy of production and handling of the product.

Dairy inspection has a broader meaning than simply looking into the dairy barn and reporting on light, ventilation, and the smoothness of walls and ceilings. Dairy inspection means, first, the coming into personal contact with the producer, and the establishing of a personal relation between the Dairy and Food Commissioner's Office and the dairyman. It means education instead of prosecution in the vast majority of cases. When dairy inspectors can prove to the dairyman that they have a detailed knowledge of milk production and handling, and when they can approach the problems of the dairyman with sympathetic interest, the prime feature of milk and stable inspection work will be accomplished.

Inspection of dairy farms will give information regarding water supply and sewage disposal, and also enable the official to judge by personal acquaintance with the dairyman the best means of accomplishing hoped-for results. By means of it he may be able to accomplish by persuasion what might otherwise fail except by most drastic methods.

The inauguration of the work was confronted with

many difficulties, especially when producers mistook the purpose of inspection, and looked upon it not as coöperative but rather as savoring of compulsion and interference. The newness of inspection work, the creation of various sources of authority emanating from various boards and commissions under federal, state and municipal control, did much to strengthen the producer in his point of view, and to encourage him to look askance and with suspicion upon the feasibility of such "new-fangled notions".

The consumer likewise failed to recognize the utility of dairy and stable inspection and often allowed his better judgment to be prejudiced, somewhat in this respect by his natural dislike of an advance in price. He had not yet become keenly alive to the fact that a superior quality of milk at an increased price might be ultimately of more economic importance to himself than an inferior milk at a much lower price.

It is most encouraging to note, however, that both producers and consumers are apparently changing their attitude toward inspection work. It is, therefore, becoming possible to render more efficient service to both producer and consumer and to demonstrate to each that inspection work is of vital concern to the best interests of both, as well as of the public at large. The producer has been more ready and willing to adopt the suggestions and recommendations of inspectors, and in most cases has so altered his methods and equipment as to comply with the general standards of clean milk production.

The consumer has gradually come to appreciate what clean milk really signifies and has not so bitterly opposed the advance in price brought about by improved conditions of production and increased cost of labor and feeds, as well. He has learned that inspection work is beginning to show definite results in concrete form of better milk and is beginning to look upon this work as his greatest asset of a guarantee against milk, all too often, unclean, unwholesome, and unfit for human consumption.

By the passage of Chapter 242 of the Public Acts of 1917 the General Assembly created a Milk Regulation Board, consisting of the Dairy and Food Commissioner, the Attorney General, the Commissioner of Health, the Secretary of the State Board of Agriculture and the Secretary of the Connecticut Dairyman's Association, the main object of which is to exercise discretionary supervision of all dairy activities of the State as related especially to producers, dealers and distributors. After holding a public hearing, this Milk Regulation Board on October 8, 1917, adopted rules and regulations concerning the inspection of dairies, the production, care, handling, marketing and sale of milk and cream. Among these rules and regulations particular attention is called to that requiring the annual registration of every milk producer and dealer in the State, and also to that forbidding the sale of the milk of any unregistered producer. It is urgently recommended that every producer and dealer supply himself with a copy of Bulletin No. 7 of this office, which will gladly be furnished gratuitously upon request, and familiarize himself with the suggestions contained therein, which are most pertinent to the efficient success of all dairy work. Without the existence of the Milk Regulation Board and the splendid work it is accomplishing in the organization and coördination of the dairy industry on a firm and lasting foundation, it would have been impossible to report at this time so much progress with the inspection work. The annual registration of all producers and dealers has been of very material assistance in the formation of a definite systematized program of inspection, and also in the accomplishment of the maximum of result at the minimum expenditure of energy, time and money. The plan of having this board act as a tribunal to which all complaints and appeals from the judgment of the officials of this office can be brought, has decided merits and is a source of not a little relief to the Dairy and Food Commissioner.

THE DAIRY AND STABLE SCORE CARD.

As already indicated, dairy and stable inspection work passed through a period of experimental incubation accompanied by more or less haphazard methods of procedure and not a few abstract and impracticable suggestions on the part of those performing the task. There was nothing definite and concrete to which the producer or dealer could refer after the inspection had been made and the same was equally true when occasion arose for reinspection.

To remedy this condition the use of a definite score card was introduced, whereby every part of a producer's or dealer's outfit was rated at a certain percentage on the scale of 100 (see score cards at center of this report). This gave producers, dealers and inspectors something tangible and specific wherewith to tabulate in no uncertain manner the various component items pertaining to the general characteristics of any particular plant. This dairy score card has distinct merits, among which the following are preeminent:

(a) A copy of the inspector's card is always left with producer or dealer to which he can refer at any time for guidance as to the most essential points of improvement to be made.

(b) No producer or dealer can bring forth a legitimate excuse for not knowing in what respects he is lacking in the essentials of clean milk production.

(c) Great emphasis has been placed upon the use of covered milk pails with small openings, as experiments have shown that their use has reduced the bacteria content in milk in many cases 50%. We, therefore, allow ten points for this one item, and a large number of producers have installed covered pails as a part of their equipment.

(d) The producer or dealer is often surprised to learn how by the exertion of comparatively little time and money he can improve his methods and equipment so as to secure

a higher rating. This is in itself a great impetus to the production of clean milk.

(e) It is possible to check up in a direct way the sanitary condition of any particular distributor's plant, which is often found to be so unclean as to counteract whatever efforts the farmer had previously made in the production of clean milk.

(f) When the time for reinspection comes, a definite basis is at hand for the measurement of improved or inferior conditions on the part of the particular producer or dealer involved. The question of relative terms and theoretical arguments of partially remembered facts are removed.

Making use of the information secured through the enforcement of the requirements of the Milk Regulation Board and by the adoption of the score card system of inspection work (with the larger number of qualified men appointed by this department for this work), it has been possible during the past year to inspect practically every producer's or dealer's outfit in this State. More recently the task of reinspection was taken up which at once demonstrated incontrovertibly the absolute necessity of making a thorough reinspection, if for no other purpose than to spur on the individual producer or dealer to the up-keep of standards and cleanliness. It is not going too far to state, in all earnestness, that the value of a first inspection is well nigh entirely obliterated if it is not followed up by a reinspection within a reasonable time. Then, too, in many cases where inspectors find it necessary to make important suggestions for improvement, it is essential to see to it that such recommendations are executed. In this connection much gratification is had in being able to report that in many cases where reinspections have been made, decided improvements have been found and a much higher rating secured on the score card.

Such evidence of the results of inspection work are most

encouraging and point unerringly to the unquestioned advisability of and necessity for the continuation of the work, and especially for as frequent reinspections as are in accord with the facilities of this office.

It is a sincere pleasure, also, to state that much material assistance has been rendered the officials of this department by the hearty coöperation and work of the Commissioner of Health and various health officials throughout the State. They are in a position to come into contact with various phases of dairy work, and to their vigilence and watchfulness this department owes much, for the effectiveness of the regulation of dairy activities, as well as for the maintenance of standards and sanitary conditions.

It is the purpose of this department to continue inspection work and reinspection work, to make it more efficient, more coördinate, and more centralized. Dairy inspections must be perfected to the point where they shall be recognized by producer, dealer and consumer as inextricably interwoven with the vital interests of each. It is urged that inspections be dealt with in a spirit of frank and hearty coöperation by all concerned therein. Criticisms and suggestions, favorable or otherwise, are invited. It is only thus that the officials of this department can make inspection work mean as much as it should and it is only thus that the highest welfare of the dairy industry can be permanently subserved.

From October 1, 1916 to April 1, 1918 there were 3,760 inspections of which we have record made on the former method of inspection, covering 123 towns in the State, four men working. Beginning April 1, 1918 and ending September 30, 1918 there were 5,155 inspections made on the new score card system, these inspections covering 160 towns in the State. There was also special work done, consisting of 181 days' work, of the several inspectors combined. 2385 of these stable inspections, where improvements were needed, were followed by a letter of instruction with the request that as soon as improvements were completed to

notify this office, and it is very gratifying to this department to know that the inspectors' work was well received and complied with, as testified to by the large number of replies stating the improvements or recommendations had been completed.

This practically completes inspection work covering every town in the State as is shown by record on the books of this office. During the latter period three more inspectors were added to our working force.

In order to carry forward this work as outlined, it will be necessary to retain at least the present number of inspectors. Furthermore, it must be borne in mind that during the past few years the cost of living, hotel rates and restaurant charges have increased many fold. Traveling expenses, railroad fares and automobile maintenance have likewise become much more costly. The appropriation asked of the General Assembly of 1917 by this Department was based on estimates of the then existing prices. It is estimated that for the next two years the expenditures of this department will be increased by 40% at least.

FOOD CONTROL.

For the past two years the food control work of this department has been related mainly to the attention to complaints of various kinds and to particular care that the sale of all foods shall be according to statutes and not otherwise. Neither the resources of the department nor the size of the appropriation for this work are sufficiently large to admit of any extensive or far reaching endeavors to go minutely into the details of the manufacture or sale of the multitudinous varieties and degrees of substances offered for human consumption.

Nor does it seem to be within the scope of our work to do so. Excepting in cases of gross and flagrant violations of the statutes wherein the excuses of accident or ignorance were obviously not without flaws, an effort has been made

to create and support all possible coöperation between the inspectors and the various food vendors, with the purpose, not at all needlessly annoying or harassing those people but to educate them in the details of the actual workings of the food laws and to impress upon them the fundamental principles upon which these laws are based. It is felt that a great many violations of the statutes pertaining to food are not due to wilful or deliberate disregard for or defiance of the laws but rather to the honest misunderstanding and entire ignorance of their particular applications. In this field, as well as in that of dairy and stable inspection work, it is first essential that those by whom the laws are to be obeyed, understand their purport. Otherwise it is the height of folly to expect them to be implicitly carried out. It must be thoroughly understood by all concerned, however, that if after due inspection, explanation and warning on the part of our inspectors, anyone is found guilty of violation of the food laws, he should not expect any great amount of leniency or sympathy from the officials of this department. In other words, it is to be hoped that the department will meet with voluntary compliances on the part of all those who dispense food articles for sale and it must also be borne in mind that rigid prosecutions can be enforced, if necessary.

CHEESE.

The manufacture and sale of domestic cheese, has grown tremendously and has developed into an industry which must be recognized and controlled. Whereas, it is true that the cheese industry is as yet in its infancy and cheese has not become widely established as an article of food to be used frequently although containing abundant nourishment in a small, compact form, the further development of the cheese industry should be encouraged and directed along the proper lines. To this end, this department has made several inspections concerning cheese manufacture and has insisted that wherever such cheese is made,

Dairy and Food Commissioner's Department

STATE OF CONNECTICUT.

SANITARY INSPECTION OF DAIRIES.

Owner ..... Town. ..... Street or Road .....

Lessee ..... P. O. ..... R. F. D. .....

Cows milking ..... Dry ..... Young stock ..... Pure bred .....

Mixed breed ..... No. quarts milk per day .....

How sold Wholesale Where

Grade: *Pure Bred:* Retail Sold .....

Jersey .... Date ..... A. M. ..... P. M. .....

Holstein ....

Ayshire .... Inspector .....

Guernsey ....

Bull kept: Breed ..... Grade ..... Pure bred .....

DAIRY SCORE CARD.

Classification			SCORE Per	SCORE Allw			SCORE Perfect	SCORE Allow'd
Excellent	80 or above							
Good	60 to 80							
Fair	45 to 60							
COWS			14		**UTENSILS**		16	
1.	Apparently healthy and in good condition	4	....	....	25.	Milk pails, cans, etc., are of metal, smooth, in good repair, seams soldered flush	2	....	....
2.	An official tuberculin test made annually of all animals over 6 months of age and all reactors removed	6	....	....	26.	Where strainers are in good repair and cotton discs or filter cloth are used	3	....	....
3.	Flanks, udders and teats are clean	4	....	....	27.	Racks are provided in a clean place to hold cans, pails, strainers, etc., inverted or covered when not in use	1	....	....
4.	Flanks and udder clean as determined (4, 3, 2, 1)		....	....					
COW STABLES			32						
5.	Free from contaminating surroundings	2	....	....	28.	No. 1 approved method	10	....	....
6.	Live stock other than neat cattle excluded from stable in which cows are kept	2				(All metal milk handling utensils made clean by washing immediately after using)			

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Dairy and Food Commissioner's Department

STATE OF CONNECTICUT.

SANITARY INSPECTION OF DAIRIES.

Owner . . Town Street or Road

on the farm, there be a room or other suitable place set apart for this work which should not be contaminated by having various other activities performed therein. The standard of quality of the Italian Cheese has been carefully watched from time to time. It is to be desired that the domestic consumption of cheese be increased to a large extent, not only because of the character and amount of nutriment contained therein, but also because there are few forms into which farm and dairy products can be converted so easily and so compactly at so little expense. The manufacture of cheese, moreover, is an excellent method of taking care of a certain amount of surplus milk from time to time, thereby affording the farmer an opportunity of disposing of such milk to an economic advantage as otherwise much of the nutritive value of this milk would be lost and a corresponding large economic waste experienced. It is heartily recommended that not only farmers but the consuming public as well, take up the matter of cheese manufacture and consumption more seriously and more intently.

The people of this country are being taught as never before the relative value of foods and the function which they perform. This means that people will, in time, pay some attention, when purchasing foods, to their food value as well as to their palatability. Already many people have learned that dairy products will take the place of a portion of their meat diet and that they are as well nourished. In many cases the eating of less meat has been beneficial, especially to persons following sedentary occupations.

This department stands ready and willing to do all in its power to encourage and further the growth of this comparatively new industry along proper and legitimate lines.

INSPECTIONS OF STORES, BAKERIES, RESTAURANTS, AND HOTELS.

The increasing large number and variety of stores and restaurants in the growing populations of our larger cities, brings to the front more seriously their supervision and

control. It has been found that the sanitary conditions of such stores, and the various forms of impositions practiced by the owners upon the unsuspecting public, cannot be passed over lightly or accepted as among the necessary evils of modern community life. Whatever sanitary conditions were found inimical to public health and safety, were brought to the attention of local health officials.

It has not been such a simple matter, however, to keep under control, the great variety of impositions in actual practice. There is, perhaps, a natural tendency on the part of some storekeepers to keep within the letter of the law without actually complying with its obvious purposes. For instance, the laws regarding the sale of such articles as tub butter, renovated butter, cold storage eggs, etc., demand that these articles be offered for sale in an absolutely definite and specific way, so that in the minds of the purchasers, there shall be left no doubt, whatever, as to the exact nature or character of the article to be bought. The whole intent of these laws is to protect the consumer against fraud. It would appear that every fair-minded merchant should appreciate the wisdom of observing the various food statutes for the preservation of his own character and reputation if for no other reason yet it has been frequently found that however willing such storekeeper may be to abide by the statutes, openly and above board, they have been induced to use subterfuges and camouflages of one form or another, simply because a certain element of the purchasing public display a false pride in preferring not to be told or have it known that they are buying cold storage or "made-over" articles of various kinds. Thus, to a certain extent, it seems that the public encourages the storekeeper in his dissimulation of the true character of certain articles. Why is it that "renovated butter" and "cold storage eggs" should be tabooed as indicative of something to be kept in the dark and apart from one's friends and acquaintances, is beyond sensible comprehension. The encouragement of the artificial stigma

attached to such terms, is absolutely wrong and unjust in every respect. Until the public realizes its mistake in this respect and consents to accept such articles for what they are, it will be very difficult indeed to prevent merchants from trying to cover up their true character.

LABELS AND ADVERTISING.

From what has been said it should be clearly evident that the main trouble to be cared for in supervising the sale of articles of food, is false representation of the true character, nature and composition thereof. In the last analysis, the Food and Drug Acts, owe their existence to an endeavor to see to it that the purchaser gets what he pays for and is not given that which he not only does not want but which is of inferior value to that for which he presumes he is paying. There is a current opinion that the question of the healthfulness of foods should be emphasized by this department. Whereas this is true to a certain extent, the department feels that it has little jurisdiction in the matter as to whether or not a more or less healthful or wholesome article is offered for sale. It simply concerns itself, first, last, and always, with the exertion of every means at its command to compel merchants not to misrepresent articles of food in any way, shape or manner. For instance, it is no concern of the department as to whether a man wishes to purchase fresh butter, renovated butter, or oleomargarine, but the department intends to see to it that persons get what they ask for and do not pay the price of fresh creamery butter for renovated.

In order to assure to the consumer the privilege of exercising his judgment in making purchases, several laws have been adopted by the Federal and State Government and also by the Interstate Commerce Commission, to the effect that such products as oleomargarine, renovated butter, cold storage eggs, etc., shall be labeled plainly and unmistakably, not only in the original packages in which they come into any particular store but also in the refrigerator, in the

show case, on the counter, in the display window or wherever they happen to be exposed or offered for sale. To see to it that such labeling is properly and legally performed, comes under the jurisdiction of the work and authority of this department. But it must be remembered that inspectors cannot be in every store, restaurant, and hotel at every hour of the day. If, therefore, false labeling or fraudulent advertising is practiced, the consumer should immediately notify this department of such facts and failing so to do should not complain if he is occasionally imposed upon. In the last analysis, however stringent the food laws may be, however exact labeling and advertising requirements are, and however large the number of inspectors at work, the final act of any specific imposition or false representation to a particular purchaser, rests upon him alone for its fulfillment. A little care and observation on the part of the purchaser, will go a long way toward the gradual elimination of false labeling and fraudulent advertising. Nothing will deter such practices as rapidly as the open and manifest disapproval of them by public opinion. To the public, the merchant must look for his trade and for the means of gaining his livelihool. How that trade shall be conducted, how far the merchant may go, in nefarious practices, rests on the public alone. The offering for sale of fresh grass butter at 45c per pound in the month of January, when there is no fresh grass butter on the market and when the price of fresh butter averages 70c. a pound, should be warning sufficient. Neither should newspaper advertisements, offering strictly fresh eggs at 50c. per dozen when the market price is 80c. per dozen, hoodwink an individual into thinking that he is actually getting strictly fresh eggs at a bargain. Instances of this nature are not uncommon and it behooves the consumer to exercise vigilant care against them.

Obviously, the whole subject of food control and its accompanying inspection work, is inextricably interwoven with the personal problems of providing for the household

and the table. Herein enters a purely personal element, the question of personal taste and preferences. How far food control work influences these things cannot be measured in accurate terms. How far the aims of this work should be is another unsolved problem. The opportunities for service and for improvement are limitless in their ramifications. The amount of energy, time and money that can be spent in the control of food articles is likewise beyond measure. The whole question simply resolves itself into how much of the exercises of personal functions, the public wishes to delegate to official action. There is a point, however, of diminishing returns to the individual in this respect and it would seem to be for the best interest of all parties concerned, not to infringe in any way, shape or manner upon the privacy of household and family affairs but simply to see to it that all foods are offered or exposed for sale in their true character and their true nature and to leave the rest to individual initiative.

BREAD.

Early in October of 1917 the Federal Food Administration requested this department to make a survey of the conditions under which bread was sold, especially to find to what extent it was sold without a wrapper, also what percentage would weigh up to the net weight marked upon the wrapper, and the price charged for the same.

In accordance with this request inspectors were detailed to the principal cities of the State to find out from bakers, wholesalers and retailers to what extent the bread would come up to the requirements printed on the wrapper. Three hundred and twelve inspections were made and in only a very few cases did the goods come up to the weight printed on the wrappers.

The rapid increase in the price of flour had caused a diminution in the size of the loaves, and in many cases they were still using their old wrappers, but in nearly every

instance agreed to obtain new wrappers to meet changed conditions as soon as possible.

We are confident that this survey was of very material advantage to the purchasers of bread.

LICENSING OF MANUFACTURERS, DEALERS AND USERS OF OLEOMARGARINE OR RENOVATED BUTTER.

Chapter 264, Public Acts of 1917, provides that no person shall manufacture, sell, offer or expose for sale, or have in his possession, with intent to sell or use, oleomargarine, butterine or renovated butter unless annually licensed by the Dairy and Food Commissioner. Applications for such licenses shall be accompanied by the following fee payable to the Treasurer of the State:

For making oleomargarine, butterine or renovated butter, twenty-five dollars;

For selling oleomargarine, butterine or renovated butter in quantities of more than ten pounds, five dollars;

For selling oleomargarine, butterine or renovated butter at retail, in quantities of not more than ten pounds, two dollars;

For the use of oleomargarine, butterine or renovated butter by an hotel, restaurant or dining room, one dollar.

This law has had a very beneficial effect on the control of the above mentioned products, but I would recommend that the license fees be increased as follows:

For making oleomargarine, butterine or renovated butter, fifty dollars;

For selling oleomargarine, butterine or renovated butter in quantities of more than ten pounds, twenty-five dollars;

For selling oleomargarine, butterine or renovated butter at retail, in quantities of not more

than ten pounds, ten dollars;

For the use of oleomargarine, butterine or renovated butter by a bakery, hotel, restaurant or dining room, five dollars.

Oleomargarine is an imitation product susceptible to fraud and deception, and it should be under close supervision. The license fee should be adequate to cover all expense incident thereto. A higher license would also be treated with more respect, as we find that not only the licensee but even Court officials feel that it is only a matter of small concern where there is such a small license fee charged.

Two thousand seven hundred and sixty-eight inspections of stores, hotels and restaurants under the new license law have been made, and a large number of violations were found. Many of these, however, were through ignorance of the law, and it has been the policy of this department to educate dealers and users to a full meaning of the law for the first year rather than to wage a vigorous campaign of prosecution.

We are now well started on the second year of this license law, and there is at this time a close survey being made of the manner in which wholesalers, retailers and users are observing this new law, and while we find a great many slow to renew licenses, yet town and city prosecutors are loathe to bring action on so-called "first offenses". Many of them, however, have issued letters of warning to persons or firms who have been found by our inspectors violating the oleomargarine law, stating that unless they complied immediately and renewed their license at the proper time they would be prosecuted to the extent of the law.

There has been no attempt by this department to discredit the use of imitation butter, but as in the case of other food products it must be sold under the supervision provided by the statutes.

SUMMARY OF SAMPLES TAKEN

Name		No. of Samples	Adulterations	Hearings	Prosecutions
Baking Powder		1	0	...	...
Butter					
Creamery		14	(	...	...
Farmers		9	(8	8	...
Tub		12	0	...	...
Renovated (process)		1	...	1	...
Cocoa		1	1	...	...
Commercial Feeding Stuffs					
Cotton seed meal		10	(	...	...
Dairy feed		1	(	...	...
Horse feed		1	(5	6	1
Laying mash		1	(	...	...
Stock feed		2	(	...	...
Cream		11	1	1	1
Egg substitutes					
Yelco		1	0	...	...
Flour					
Corn meal		1	1	...	...
Rye meal		1	...	...	...
Wheat		1	...	...	...
Jellies					
Pure Grape		1	0	...	...
Milk		1966	...	...	...
O. K.	1023	...	...	...	...
Below Standard	619	...	...	72	14
Watered	224	...	...	221	105
Skimmed	100	...	...	96	40
Oleomargarine		26	13	5	2
Olive Oil		93	27	23	...
Pie					
Apple		15	1	1	...
Prune		13	1	1	...
Squash		1	0	...	...
Sauce					
Apple		4	0	...	...
Cranberry		2	0	...	...
Sausage					
Pork		41	8	4	...
Spice					
Cloves, ground		7	(	...	...
Ginger		10	(	...	...

Name	No. of Samples	Adulterations	Hearings	Prosecutions
Pepper, black	9	(6	6	...
cayenne	16	(	...	...
white	7	(	...	...
Steak Hamburg	33	8	8	...
Sugar				
Brown	2	0	...	...
Granulated	4	2	...	...
Sweet Cider	1	0	...	...
Turpentine	1	0	...	...
Vinegar				
Cider	42	(	...	...
Molasses	1	(8	6	...
White Wine	1	(	...	...
Barber's Supplies				
Bay Rum	8	5	...	...
Eau de Quinine	3	3	...	...
Toilet Waters	5	2	...	...
Hair Tonic	7	4	...	...
Scalp Massage	5	1	...	...
Miscellaneous	4	1	...	...
Drugs				
Strychinine Sulph.	7	1	...	...
Formin, 5 gr.	3	0	...	...
Acetanilid Co.	4	0	...	...
Migrane Tabs.	7	2	...	...
Blaud's Co.	3	0	...	...
Elixer I., S. & Q.	5	0	...	...
Quinine Tabs., 2 gr.	5	0	...	...
Calomel Tablets	21	2	...	...
Sodium Salicyate	5	1	...	...
Antiseptic	7	1	...	...
Phenolphethalin	4	1	...	...
Carthartic Co.	3	0	...	...
Nitro-Glycerine	3	0	...	...
Tinc. Iodine	2	1	...	...
Aspirin Tablets	4	1	...	...
Headache Tablets	2	0	...	...
Cold Tablets	2	0	...	...
Sodium Bromide	2	0	...	...
Neuralgic Tablets	2	1	...	...
Digestive Tablets	3	1	...	...
Wine ColchicumSeed	2	2	...	...
Miscellaneous (single samples)	50	5	...	...

EXPENSE ACCOUNT.

Commissioner's salary	$ 4,000.00	
Office and traveling expenses		$ 5,158.22
Deputy Commissioner's salary	3,200.00	
Office and traveling expenses		2,005.58
W. J. Warner, services	2,521.50	
W. J. Warner, expenses		3,265.70
G. T. Fowler, services	2,436.00	
G. T. Fowler, expenses		2,028.82
J. M. Whittlesey, services	480.00	
J. M. Whittlesey, expenses		632.63
W. F. Potter, services	787.25	
W. F. Potter, expenses		884.88
R. F. Kimberly, services	701.00	
R. F. Kimberly, expenses		907.72
J. C. Gilbert, services	456.00	
J. C. Gilbert, expenses		405.81
F. H. Paine, services	780.00	
F. H. Paine, expenses		968.40
I. P. Campbell, services	732.00	
I. P. Campbell, expenses		755.01
H. L. Benze, services	830.00	
H. L. Benze, expenses		658.19
	$16,923.75	$17,670.96
Total		$34,594.71

CREAMERIES

Name of Creamery	Location	President	Secretary	Superintendent	Butter Maker	Capital
*The Bryant & Chapman Co.	Hartford	W. M. Bryant	B. W. Chapman	W. S. Patrick	H. Patrick	$ 99,000
Canton Creamery Co.	Canton Center	C. R. Quick	S. W. Bristol	S. W. Bristol	R. C. Bristol	2,675
**Cedar Hill Ceamery Co.	Cedar Hill	.....	.....	.....	.....	1,000
**Danbury Creamery & Haviland Dairy	Danbury	H. A. W. Schneyer	.....	.....	H. A. W. Schneyer	10,000
**East Canaan Creamery Asso.	East Canaan	.....	E. S. Roberts	D. E. King	D. E. King	.....
Granby Co-op. Creamery Co.	Granby	G. O. Beach	S. F. Holcomb	H. W. Fuller	H. W. Fuller	2,975
The Jewett City Creamery Co.	Jewett City	W. C. Terry	B. C. Bliss	B. C. Bliss	B. C. Bliss	4,000
Lebanon Creamery Co.	Lebanon	T. D. Blight	O. L. Pultz	O. L. Pultz	O. L. Pultz	3,400
*Litchfield Creamery	Litchfield	W. T. Marsh	W. G. Granniss	M. D. Beach	L. A. Dickinson	2,200
Ned's Brook Creamery Co.	Canton	James Case	J. M. Gladwin	J. M. Gladwin	J. M. Gladwin	1,125
**Simsbury Dairy Co.	West Simsbury	E. A. Hoskins	O. D. Tuller	O. D. Tuller	A. Vincent	2,500
**Torrington Creamery	Torrington	.....	.....	.....	.....	.....
**Tunxis Creamery	Colebrook	.....	A. L. Lewis	A. L. Lewis	A. L. Lewis	2,500
The Vernon Creamery Co.	Rockville	G N. Skinner	A. R. Lathrop	A. W. Annis	A. W. Annis	3,500
*Wapping Creamery Co.	Wapping	H. A. Slater	C. J. Dewey	C. J. Dewey	D. Johnson	3,500
**Winsted Creamery	Winsted	G. E. Manchester	G. E. Manchester	G. E. Manchester	.....	.....

*Incorprated
**Proprietary
All others co-operative

State of Connecticut

PUBLIC DOCUMENT No. 53

REPORT

OF THE

State Tuberculosis Commission

43

TO THE GOVERNOR

For the Period Beginning October 1 1916
and Ending September 30, 1918

PRINTED IN COMPLIANCE WITH STATUTE

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THE BOARD OF CONTROL.

STATE TUBERCULOSIS COMMISSION.

DR. STEPHEN J. MAHER, New Haven..Term expires July 1, 1923
WALLACE S. ALLIS, Norwich.....Term expires July 1, 1919
ARTHUR R. KIMBALL, Waterbury.....Term expires July 1, 1921

Secretary
GEORGE I. ALLEN.....Middletown

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REPORT

OF THE

STATE TUBERCULOSIS COMMISSION

State of Connecticut

To His Excellency, Marcus H. Holcomb, Governor, and to the General Assembly:

The closing of the period of two years, covered by this report, found the Connecticut campaign against tuberculosis suffering, like so many other of the State's ordinary activities, from the paralyzing effects of war and pestilence.

The first of these terrible afflictions has now disappeared, but in order to appreciate the importance of the doings herein recorded, it is necessary, in these happier days, to remember that the war took from our sanatoria more than half of our staff of physicians, many of our nurses and orderlies and farm hands, and made necessary the increasing of salaries and wages, and the paying of extraordinary prices for food and for construction material, and that the influenza epidemic caused us to erect a quarantine in all our institutions, and incapacitated and even killed nurses, kitchen help, and patients. Bearing these points in mind, the readers of this report must agree, that in the war against tuberculosis, Connecticut continues to "carry on." She has kept her patients supplied with as good food and as many comforts as in times of peace. She has increased the capacity of her sanatoria nearly one third. She has secured the site for her long-desired seaside sanatorium for her children suffering from bone and glandular tuberculosis. She has increased the fire protection at the sanatoria. She has supplied tuberculosis experts to the draft boards. She has given moral and financial encouragement to the visiting tuberculosis nurses and dispensaries of the State. She has supplied factories and schools and societies and newspapers with anti-tuberculosis literature. She has supplied moving picture films on tuberculosis to the principal theaters of the State. She has aroused among the physicians of the State and, in fact, among all of the thoughtful and large-hearted citizens of the State, such a sympathetic interest in her campaign against tuberculosis, as would not have been possible a few years ago, and is hardly to be duplicated in any other community of this or any other country.

Wiping Out the Waiting List.

In our last report, we laid emphasis on the need of more beds, and told of the indignation that the long waiting list of applicants for admission to our sanatoria, aroused throughout the State. In view of the completion, at that time, of the splendid sanatorium of the New Haven Hospital on the Allingtown Hills, we reasoned that an increase of 60 beds at Shelton, and 40 beds at Norwich, and 100 beds at a seaside sanatorium, would enable us to obliterate our waiting list and leave us a comfortable margin of safety.

The quick looming of the great war cloud, during the winter and spring of 1917, caused the General Assembly, then in session, to cut down our expected appropriation of $125,000 for the seaside sanatorium to $25,000, and the National Government took over the sanatorium at Allingtown for the use of tuberculous soldiers.

For the obliterating of the obnoxious waiting list, we had, therefore, to depend on the appropriation of $60,000 for completing the infirmary at Shelton, and $20,000 for erecting a new infirmary at Norwich. At the most, these were not expected to give us more than 100 new beds. And then to increase our perplexities, we found on opening the bids for the completion of the Shelton Sanatorium according to the original plans, that none of the bids came within our appropriation. It was necessary to materially reduce the size of the proposed addition. We have now completed the building at Shelton, according to the revised plans, and instead of the expected 60 new beds we have 86 new beds.

At Norwich, we found that it was not possible to be sure of even 20 beds in a new building that would cost less than $20,000. We appealed to the Board of Control and submitted our plans and bids, and our appropriation was raised to $25,000. With this small sum, thanks to the advice and hearty co-operation of local architects and builders, we have succeeded in erecting a fine two-story building with a capacity, not of 20 beds nor of 40 beds, but of 60 beds! This we consider something of an achievement. For some time to come, these 146 new beds will do away with most of the distressing delays in admitting patients, unless, as some of the authorities predict, there should be a great increase of tuberculosis in the community, due to the returning troops and to the influenza.

At Last a Seaside Sanatorium.

As we have stated in previous reports, the tuberculosis experts of the world long ago observed that children afflicted with surgical tuberculosis, that is, tuberculosis of the bones and glands, recovered health and strength in a most marvelous way if they were permitted to live for a few months at the seashore.

The last International Tuberculosis Congress, after discussing the subject at great length, passed the following resolution: "In the view of the need that there is of treating surgical tuberculosis in special sanatoria, and in view of the success of the seaside treatment of surgical tuberculosis, this Congress solemnly resolves (*emet le voeu*) that there should be provided for cases of surgical tuberculosis, particularly for surgical tuberculosis in children, special sanatoria on the seacoast, and that the building of these seaside sanatoria should be done on as large a scale as possible, and with as little delay as possible."

Most of the civilized states of the world that possess a seacoast, France, England, Germany, the Scandinavian countries, Portugal, the countries of South America and our own neighboring communities of the Atlantic Seaboard, now have institutions of the kind described in this resolution.

Two years ago Connecticut had evidently become aroused on this subject. It then seemed to be the unanimous opinion that an institution of this kind should be provided and a bill was introduced in the General Assembly, asking for an appropriation of $125,000 for this purpose. The bill was favorably reported by the committee on humane institutions, but when it came to the committee on appropriations the demands of the State for money were so great that this committee did not feel justified in drawing so largely upon the State treasury for a new enterprise, consequently, the amount was cut down to $25,000. To carry out the wishes of the State expressed by this appropriation, this Commission continued its search for a suitable location for such an institution and finally purchased the so-called White Beach Hotel property at Crescent Beach, in the town of East Lyme, for the sum of $12,000. This property has an attractive beach, is well removed from the thickly settled portion occupied by summer residents, and consists of the hotel building with about 30 rooms, substantially finished, besides two acres of land, a small summer cottage and outbuildings. With the addition of a heating plant and some changes and repairs in the water and sewage systems, the property will be well adapted for a small institution of the

kind desired. A much larger appropriation is necessary, however, if the State is to accomplish what we believe it desires to do and what other States about us are doing for its children crippled with bone and glandular tuberculosis. Adequate provision should be made for the equipment and maintenance of such an institution.

Need of Co-operation by the General Hospitals.

Again this year, we would call the attention of the General Assembly to the need of compelling the general hospitals of the State to provide a ward or separate building for the care of emergency and dying cases of tuberculosis.

In this new, after-the-war era, the public will no longer tolerate the view apparently entertained by some directors of general hospitals, that the functioning of these institutions can be restricted to such medical activities as interest the principal surgeons and physicians. The instant use of so many of the general hospitals of the State, during the recent influenza epidemic, and the surrendering of ward after ward to the care of patients sick with this terrible and contagious disease, afforded striking proof of the service that the general hospitals can give and must give to their communities. Yet, if in these same communities, the local visiting nurses discover a tuberculous father or mother, endangering his or her children, and too sick of fever or hemorrhages to be removed to the distant sanatoria, these same hospitals, that so splendidly helped in the influenza epidemic, will reply with an emphatic "No" to the request of the nurses that their tuberculous patient be admitted and cared for until such time as he or she dies or improves sufficiently to make a transfer to a sanatorium possible and desirable.

This attitude of the general hospitals is indefensible. It is due to the discarded panicky notion that the consumptive is of necessity and always a source of danger to his neighbors. There is nothing dangerous about a consumptive but his sputum, and that danger is so easily controlled in a hospital or infirmary ward, that these wards are now about the safest place in the world for the man or woman who is afraid of "catching" the disease.

This attitude of the general hospitals, and the length of the recent waiting lists at all the State's sanatoria, have forced some of the largest cities to a compromise, helpful but not satisfactory. These cities, New Haven, Hartford, and Bridgeport, have sent many of their waiting and emergency cases to buildings or wards

on their town farms. Of course, the ordinary citizen of Connecticut would not willingly himself, go to a town farm, nor would be permit his wife or children to go there, even to be treated for tuberculosis. And it is for the benefit of the ordinary citizen of Connecticut, bleeding or dying from tuberculosis, that we make this appeal to the general hospitals of Connecticut.

The expense of caring for these emergency cases ought to be borne in part by the State and in part by the town or city. It seems to us, that, after considering this matter and when considering requests for financial assistance from the various general hospitals of the State, the committee on appropriations could wisely formulate a bill defining the conditions under which the State would help to pay the hospitals for the care of these emergency cases of tuberculosis. The number of these cases would never be large in any one hospital, but the suitability of the care and treatment given ought to have the sanction of the State Tuberculosis Commission, and, of course, we would always be eager to receive into the sanatoria patients from the hospitals who showed any promise of improvement.

Consumption Kills More City Men and More Country Children.

Consumption kills more men than women, and more girls than boys. In the city consumption is less fatal to children of both sexes than in the country. The men of the country and the women of the country, and the women of the city die from tuberculosis at about the same rate. The men of the city die from tuberculosis at a rate twice as high as that of the women of the city or the men or women of the country.

These are the facts just published as the result of an elaborate and painstaking study of the vital statistics of England and Wales. The tuberculosis death rate of England and Wales are very similar to those of Connecticut, and both rates have been diminishing in about the same way for the last sixty years.

The importance to us of these findings, if applicable to Connecticut, can hardly be exaggerated. We have endeavored to learn from our records in the office of the State Board of Health whether or not they told the same story as the British records. Our investigations have been very graciously assisted by the officials of the State Board of Health. For comparison we have taken the record of the year 1917. It has been necessary not only to reclassify the returns according to age periods, and to sexes,

but also to correct the returns from the various towns by adding or subtracting the deaths from tuberculosis in the sanatoria and other public institutions and placing them in their proper places for tabulation. The results as shown by the appended map and chart are surprising and interesting. Of course, the fact that our digest of the tuberculosis conditions in Connecticut covers only one year makes it less important than the British digest, but the important fact is developed that in the year of 1917 tuberculosis picked its victims in Connecticut in about the same way that it has been accustomed to pick its victims in Great Britain for the last twenty years.

For purposes of classification, we have considered as "rural" all towns of less than 5,000, and as "urban" all towns of more than 5,000. This is a common classification. It is open, of course, to the criticism that in a few towns of less than 5,000 a large proportion of the adult males work in factories in their own or adjoining towns. Again, as will be seen from the figures in the map, the average density of population of the "rural" towns in some of the counties is higher than the average density of population of the "urban" towns of other counties.

CONNECTICUT DEATHS FROM TUBERCULOSIS IN 1917.
PER 100,000 LIVING.

Adults.	*Male.*	*Female.*
Rural (towns of less than 5,000 population)..	47	32
Urban (towns of more than 5,000 population)	74	44

Children	*Male.*	*Female.*
Rural (towns of less than 5,000 population)..	3	3
Urban (towns of more than 5,000 population)	3	5

The deductions from these findings will be various and conflicting, but all can agree that findings of this kind show how important it is that the fight against tuberculosis should be carried into the factories, stores and offices, where city men work. They demonstrate, also, how valuable a fighting force Connecticut has in the various anti-tuberculosis associations of employees in her factories, and stores and offices. Officered by enthusiastic and able men, whose only ambition is to be of service to their fellows, and not only giving financial and moral support to their sick, but also exercising a tremendous influence in securing such factory and office and store conditions as will best safeguard themselves and the public from the terrible disease, they deserve from Connecticut recognition and support.

It is our purpose, during the coming years, to hold a conference with these societies and the other anti-tuberculosis organizations of the State, and to keep the people of every town acquainted with the anti-tuberculosis work done, not only in their own town, but in every other town in the State. Heretofore, the publicity functions of the Commission have reached only individual towns, cities, organizations, churches, factories, and schools. We hope for even more satisfactory results as the result of the "getting together" that we are planning.

Our Debt to the Newspapers.

In spite of the public absorption in war news, and in spite of the difficulties under which they labored because of the scarcity of print paper, the newspapers of the State have been extremely generous in giving us space for propaganda of the fight against tuberculosis. This has been especially noticeable at Christmas time, when the drive for the sale of Red Cross Christmas seals has been under way.

Our Sale of Christmas Seals.

Perhaps a few words about the Red Cross Christmas seal sale, and our connection with it, may not be out of place. Occasionally, a citizen receiving a request to buy these Christmas seals, has written to us to say that, in his opinion, a Commission of the State of Connecticut should not be engaged in superintending such a petty business. Usually, however, when the facts of the situation were made clear to him, his feeling of irritation disappeared and he himself entered whole-heartedly into the "drive." These facts are:

1. We took up the supervising and extending of the sale of these seals, at the request of the National Tuberculosis Association, which was the agent of the American Red Cross.

2. By conducting and energizing the "drive"; by enlisting all the school children of the State; by circulating tracts and leaflets and placards through the schools, factories and stores, and by securing the assistance of public speakers and proprietors of theaters, in setting forth the facts about tuberculosis, we were doing exactly what Section 13 of Chapter 183 of the Public Acts of 1913 directs us to do.

3. The gross proceeds of the sale of the Christmas seals in the State are about $40,000. According to our contract with the

American Red Cross and the National Tuberculosis Association, the local agencies keep 85% of the amount of their sales and send to us the remaining 15%. We send 10 of these 15% to the National Tuberculosis Association and the Red Cross. The remaining 5% we were supposed to keep to pay for our expenses in conducting the "drive." As a matter of fact, we return this 5% to the local agencies and keep none of it to pay for our central expenses. We are enabled to be thus generous because of a mail order sale that we conduct through those less thickly settled portions of the State, where we have not been able to establish local agencies to conduct the campaign. This mail order sale differs in no wise from the mail order sale in use by the fifty-odd local agencies in the larger communities of the State. This mail order income last year was $7,000. From this sum we offered every town, in which we have conducted the sale, such amounts as the town desired for helping in anti-tuberculosis work. Out of the balance we have sent again to the visiting nurse associations and the tuberculosis clinics of the larger cities, such sums as, in answer to our inquiries, they said they needed.

Because of the desire of the Red Cross to use this coming Christmas time for its great Roll Call, and its willingness to appropriate to the tuberculosis agencies a sum equivalent to the proceeds of last year's seal sale, the seal sale has been suspended for this year. However, next year we hope to arouse the anti-tuberculosis sentiment at Christmas time, with the Christmas seal.

Concerning Claims for Compensation.

The considerable number of employees at the four sanatoria, working on the farms and in and about the various buildings, makes it certain that every year we will be obliged to pay compensation for injuries sustained by our servants. Already we have had several experiences with awards by the Compensation Commission. The amounts thus far have not been large, but it is not without the range of the probable that some accident would cause us to pay, for compensation to our injured employees, sums large enough to make serious inroads on our carefully calculated maintenance appropriation.

Perhaps this is not a very urgent matter at present. We merely call the attention of the legislature to the possibilities of the situation, and suggest that if our department is to be subject to the awarding of damages by the Compensation Commissioners,

legislation be enacted indicating the funds from which these awards to injured employees be paid.

MERIDEN.

Dr. Dinnan has been the only physician resident at the sanatorium for much of the last year, because the army and navy took his assistant physician.

There is here a very creditable open air school for the benefit of the children patients. We were indebted to the Meriden Public School officials for sympathetic assistance and advice in the conduct of this school. There has been no new construction at Meriden during the past two years, except the root cellar, the storehouse, and the barn.

During the coming two years it will be necessary to consider the erection here of a new infirmary. The present infirmary, though kept as attractive as is possible with frequent painting and scrubbing, has about outlived its usefulness. The nucleus of the building was an old roadhouse in the days of the stage coach. Then it served for years as the town house of Meriden. Addition after addition has been made to it since it came to serve in the anti-tuberculosis campaign, but it is bent with age. Its floors are aslant. Its falling plaster brings groans from the nurses and bills to the Commission office. We will submit our plans on this subject to the proper committees of the legislature.

HARTFORD.

The Hartford Sanatorium has continued to function successfully, during the two years, in spite of the fact that the army took from it not only an assistant physician, but also its superintendent, Dr. William H. Stockwell, one of the best men in the State's service. His worth was soon recognized by the Surgeon General and he has been for months engaged in the training of the Base Hospital Medical Groups of the army.

The farming activities have been increased by the renting cheaply of an unused property of our neighbor, the J. G. Balfe Company. Expert farmers of the State have complimented us on our crops of potatoes and garden truck, for the past two years.

SHELTON.

The completion of the infirmary at Shelton has not only increased the usefulness of the institution, but it has also greatly

improved its appearance. The site at Shelton is probably more beautiful than that of any other public institution in the State. The witching view from the infirmary verandas, of gracious hills and rivered valley and distant ocean, is one not easily forgotten, and of course, beauty of environment is not a small matter to the man or woman who is obliged to leave home to fight for life or health.

Hereafter, the Shelton Sanatorium will accommodate about 175 patients. This increase made necessary the providing of more accommodations for nurses and help. This has been accomplished by remodeling the buildings known as the old farm house and the nurses' home. By this plan, a good recreation hall for patients has been provided by the first floor of the nurses' home.

Dr. Lynch, the superintendent, has been fortunate in having an assistant during most of the two years, and both have been ably assisted by the head nurse and the other members of the staff.

NORWICH.

At Norwich, Dr. Campbell was for many months without an assistant physician. Nevertheless, the work of the institution went on almost as smoothly as before, and this, in spite of the fact that the new 60-bed infirmary, the superintendent's cottage, and the new barn were in process of erection, and that it was necessary for him to keep up a constant inspection of the new work. By the first of January, we hope that Norwich will accommodate 160 patients.

NURSES AND DISPENSARIES NEEDED.

Hardly any two of the more advanced states or countries follow the same formula in treating their tuberculosis problems. Nor is it necessary that they should. Many began with putting their entire reliance on the establishment of sanatoria, public and private. The futility of this reliance has become apparent to most authorities nowadays. Germany, thanks to her highly developed Sickness and Invalidity Insurance Societies, was the first to develop an elaborate Sanatorium System. But long ago, she saw that the sanatoria were good chiefly as educational agencies, and she has since adapted to her needs the Edinburgh dispensary system. This system, founded by Dr. R. W. Phillips of Edinburgh in 1887, is now copied more or less closely throughout Europe and in many cities in this country.

According to the Edinburgh idea, all tuberculosis dispensaries should be sustained by prviate charity and should feed suitable patients to the proper sanatoria and hospitals.

In New York, many of the dispensaries are financed by the city, that is, by the Departments of Health, or by the Board of Trustees of Bellevue and Allied Hospitals, which is a co-ordinate city department. Most of the dispensaries are conducted by private organizations, associations or hospitals. All these dispensaries are under the general supervision of the New York Association of Tuberculosis Clinics, which is an incorporated organization. To each of the dispensary districts is assigned a corps of nurses, some of which are supplied by the private organizations conducting the dispensary. The city supplies several hundred nurses for the home visiting. Attached to each dispensary is an auxiliary body of ladies, who look after the families of the patients, and who are considered an almost indispensable part of the work. Every tuberculosis patient discharged from a hospital or sanatorium is reported to the dispensary in his or her district, and here again, comes directly under the supervision of the nurses.

In many places, the dispensary physicians prescribe for the patients, but in some countries, chiefly because of the complex arrangements with the insurance society or "panel" physicians, the dispensary authorities merely examine the patient and send their findings and advice to his family doctor.

We have gone into this matter at length, because, in our opinion, this State should set its hand now to a thorough development of a tuberculosis dispensary system.

It will not be difficult. Already in New Haven, Hartford, Bridgeport, New Britain, Waterbury, Meriden and Norwich, the foundations are laid. What is needed to complete the structure is such an increase in the number of visiting tuberculosis nurses as will permit the existing dispensaries, with a few additional, to extend their beneficent control into every corner of the State.

We do not intend to suggest that the State should, at this time, make appropriations from the treasury for the employment of visiting tuberculosis nurses. We are strongly of the opinion that the financing of the dispensaries is a local problem. We bring up this matter now for the purpose of showing what, in our opinion, should be the next step, and also, to make clear to the enthusiastic gentlemen, who every year propose, in the General Assembly, bills for the erection of more State sanatoria in remote

or inaccessible or thinly populated parts of the State, why their plans are not feasible, and how their enthusiasm could be made of infinitely greater value to the State and to their tuberculous neighbors. Our advice to them and to all who now desire to help Connecticut control tuberculosis is: Give your encouragement and money to Visiting Nurse Associations, to the end that they may enlarge the present tuberculosis dispensaries; that they may open other tuberculosis dispensaries throughout the State; that they may be able to do even more and better follow-up work and home work than they now do; that they may be able to compass the smaller, but valuable, undertakings of summer camps and open-air schools and preventoria, and that they may be able to make their records of the incidence of tuberculosis in the State, valuable to the health officials and to the State Commission and to all students of the subject of tuberculosis.

We have already referred to the fact that in addition to the work at the sanatoria, our physicians give expert and gratuitous assistance in the opening and conducting of neighboring tuberculosis dispensaries,—Dr. Dinnan to that of the Meriden Public Health Association; Dr. Strobel to the New Britain Board of Health Dispensary; Dr. Lynch to the Bridgeport Tuberculosis Dispensary; Dr. Campbell to the tuberculosis clinics at Norwich, at the Connecticut Mills at Danielson and at the Lawton Mills at Plainfield.

Perhaps, with the release from the army of the physicians inducted during the past months, it will not be necessary to continue our direct help to these dispensaries, but we are proud to learn, as we have learned, that these services of our superintendents have been highly prized, not only by the several managements of the dispensaries, but also by the physicians of the towns and by the patients.

Fire Protection.

The comparative inaccessibility of our institutions, the character of our buildings, and in some cases the inadequate water supply, as well as the fact that some of them are outside city fire limits, have made the question of an adequate fire protection very perplexing. The last Legislature appropriated $25,000 for fire sprinkler systems at the institutions. After careful investigation and consultations with the chiefs of the fire departments in the localities of the institutions, as well as with other experts in such matters, the sprinkler system method was abandoned as not

practical or efficient for our buildings, and a systematic plan was adopted involving an increase in water supply, more hydrants and hose and small fire extinguishers.

This work is now in progress, and is under the supervision of engineers, Ford, Buck, and Sheldon, of Hartford.

To carry out this plan, the Board of Control transferred the special appropriation of $25,000, referred to above, to "miscellaneous equipment."

THE TUBERCULOSIS PROBLEM.

In view of the fact that the State has expended large sums of money for the erection of buildings devoted to the care of its people afflicted with tuberculosis, a large proportion of our citizens are inclined to conclude that in this way the problem of tuberculosis can be solved. It is the too prevalent opinion that any resident of the State, found to be suffering from tuberculosis, can be sent at once and should be sent at once, to one of these institutions. There is an insistent and increasing demand upon us for more beds, and last winter, notwithstanding our long waiting list of nearly two hundred infirmary patients, we were in constant receipt of letters from individuals, physicians and town officials, complaining that some one, who had been found to have the disease, could not be at once received into one of the sanatoria.

The tuberculosis problem can never be solved in Connecticut or in this country, by simply increasing the institutional accommodations for its tuberculous sick. In Connecticut alone, it is estimated that there are about 16,000 cases of active tuberculosis. The State institutions and available private sanatoria cannot all together now accommodate more than 900 patients. In our opinion, it should be more generally understood that the only defensible reason for the establishment of these costly sanatoria in Connecticut, is that they shall be educational. These institutions should not be so largely filled with patients who are so sick that there is for them no hope of recovery. The proper place for such patients is in the local general hospitals, where they can be cared for with more comfort to themselves and their friends, and much less expense. It has been extremely hard for people to grasp this fact, but they have begun.

Friends of the Meriden Sanatorium.

Mrs. G. Dahlman, Meriden, Conn., magazines.
Italian Baptist Mission, Meriden, Conn., books, cards and papers for the children.
Mr. Jonathan Godfrey, Bridgeport, Conn., books and games for the children.
John White, Meriden, Conn., books and magazines.
St. Ann's Guild, New Haven, Conn., stockings with toys, books, fruit, dolls, etc., for the children.
St. Rose's Guild, New Haven, Conn., flowers.
St. Vincent De Paul Society, Meriden, Conn., clothing, shoes and rubbers.
William Jennings, Meriden, Conn., Christmas decorations.
Ladies' Aid Society,. Norwalk, Conn., fruit, slippers and boudoir caps.
Mrs. W. L. Cheney, Meriden, Conn., magazines.
Mrs. E. B. Galvin, Meriden, Conn., flowers.
Visiting Nurses Asso., New Haven, Conn., stationery, magazines and books.
J. H. White, Meriden, Conn., magazines and books.
Mrs. R. Wilson, Meriden, Conn., magazines.
Mrs. William Woodley, Meriden, Conn., magazines and cut flowers.
Mrs. W. I. Wilcox, Meriden, Conn., magazines.
Young Women's Christian Association, Meriden, Conn., ice cream, magazines and cut flowers.
Mrs. W. H. , Squires, Meriden, Conn., magazines.
Miss Margt. Robinson, Meriden, Conn., cut flowers.
Mrs. Mary McKay, Meriden, Conn., papers and cut flowers.
Women's Temperance Union, Meriden, Conn., cut flowers.
Mr. J. Sternberg, Meriden, Conn., cut flowers, magazines, papers, etc.
Mrs. Lyman, West Haven, Conn., piano.
Miss E. Ely, Meriden, Conn., magazines, papers.
St. Andrew's Sunday School, Meriden, Conn., magazines, papers, etc.
Dr. Stephen J. Maher, New Haven, Conn., candy and cigars.
Girls' Friendly Society, Meriden, Conn., candy and fruit.

Rev. John Lynch.
Rev. Patrick McCarthy.
Rev. Thomas McGarry.
Rev. N. F. X. Schneider.
Rev. A. Van Oppen.
Rev. John Ceppa.
Rev. George Bartalewski.
Rev. D. Ricci.
Rev A. T. Randall.
Rev. F. S. Lippett.
Rev. A. J. Lord.
Rev. Fred Saunders.
Rev. J. W. Musson.
Rev. F. Ludgren.
Rev. A. A. Engdahl.
Rev. Paul Kirsch.
Rev. P. Saurusitis.

Girls' Friendly Society of St. Andrew's Church and the Lutheran Church come once a month and sing to the patients in the different wards.

PRIVATE CONTRIBUTORS TO HARTFORD SANATORIUM.

Services by

Rt. Rev. Chauncey Brewster,
Rt. Rev. E. C. Acheson,
Bishops of Connecticut.
Rev. William T. Hooper.
Rev. Paul H. Barbour.
Rev. Father Ryan.
Rev. Father Dolan.

Gifts by

Trinity Church.
Christ Church.
Mrs. A. G. Rockwell.
Friendship Club, Y. W. C. A.
Ladies of South Baptist Church.
Miss Mary Daley.
Ladies of St. Rose's Guild, New Haven.
Mrs. E. B. Kibbe.
Hartford Public Library.
Ladies of Trinity Church.
Ladies of St. Lawrence O'Toole.
Mrs. A. Fulton.
Mrs. W. C. Butterfield, Saybrook.
Miss Helen D. Steele.
Charity Organization Society of Hartford.
Miss M. Wilkenson.
Miss Anna Taksar.
Miss Nickerson.
Travelers Insurance Co.
Lafalot Society.
Sunshine Society.

PRIVATE BENEFACTORS OF THE NORWICH SANATORIUM.

Red Cross.
Mrs. William A. Norton.
Miss Jane E. Bill.
Mr. and Mrs. Frank L. Woodard.
Mrs. A. N. H. Vaughn.
Mrs. B. P. Bishop.
Miss Susan Huntington.
Mrs. Everett Hall.
Mrs. William Tyler Browne.
Mrs. Charles Prentice.
Miss Winnifred Welles.
Philip Welles.
William Habekotte.
Judge and Mrs. Gardiner Greene.
Miss Ella Norton.
Miss Mary Porteous.
Mrs. H. F. Palmer.
Mr. and Mrs. Edward Higgins.
Mrs. George Lane.
Mr. and Mrs. L. O. Smith.
Miss Jane Aiken.
Mrs. Charles A. Richards.
Miss Mary E. Richards.
Mr. and Mrs. William H. Oat.
Mayor and Mrs. Allyn L. Brown.
Mr. and Mrs. James Smith.
The Misses Lucas.
Miss Elizabeth Huntington.
Mr. and Mrs. Wm. Tyler Olcott.
Mrs. Charles H. Preston.
Mrs. George D. Coit.
Miss Louise B. Meech.
Mrs. Leavens.
Mr. and Mrs. John Hawkins.
Mr. and Mrs. R. F. Burnham.
Miss Katherine Kent.
Mr. and Mrs. William H. Allen.
Mr. and Mrs. John Averill.
Mrs. Hugh Osgood.
Mr. and Mrs. Oliver Johnson.
Mr. and Mrs. Charles D. White.
Mrs. William H. Palmer.
The Misses Osgood.
Miss Elizabeth Culver.
Mr. and Mrs. Zebulon Robbins.
Mr. and Mrs. Chas. L. Hubbard.
Dr. and Mrs. T. A. Crowley.
Mr. and Mrs. Clarence Roath.
Mrs. Frank A. Robinson.
The Misses Robinson.
Mrs. Channing Huntington.
Mrs. Elizabeth Norton.
Mr. and Mrs. Charles Butts.
Miss Josephine Thurston.
Mr. and Mrs. John L. Mitchell.
Mrs. John F. Sevin.
Miss Ethel Sevin.
Mr. and Mrs. George W. Carroll.
Mrs. Charles D. Noyes.
Col. and Mrs. Charles Gale.
Miss Lydia A. Carell.
Grosvenor Ely.
Miss Blanche Hall.
The Bliss Company.
Norwich Bulletin Co.
Louis Roath.

Providence Bakery.
Utley & Jones.
The Del Hoff Hotel.
Engler's Drug Store.
William Stearns
George Keppler.
Mrs. Charles Vaughn.
The Evening Record.
H. M. Lerou.
Mrs. Lucius Brown.
John Tarrant.
Dana Coit.
Gilbert Hewitt.
Franklin Rumford.
Wauregan Hotel.
Charles Phelps.
Frisbie & McCormick.
Preston Bros.
James L. Case.
C. A. Gager, Jr.
F. D. Thumm.
Mr. and Mrs. Wallace S. Allis.
Miss Aida Watrous.
Mr. and Mrs. William Austin.
Frank Herbert.
Mrs. George Comeau.
Bishop & Bidwell.
Mrs. Ethel Collins.
Stoddard & Gilbert.
The Osgood Co.
Woolworth Co.
Reid & Hughes Co.
Porteous & Mitchell.
J. E. Moore.
Walter Gibbons.
Geduldig's.
Miss Anna Hield.
C. D. White.
The St. Rose's Guild.
Lee & Osgood.
The Toggery Shop.
Geo. W. Kies Shoe Co.
James W. Cosgrove.
The Hamilton Co.
Murphy & McGarry.
The Manhattan Shop.
Perkins' Candy Store.
Peterson's.
J. M. Young.
Cranston Co.
The Mohican Store.
Jordan Co.
Stephen Kehoe.
J. McPherson.
Mrs. F. S. Camp.
C. L. Swan.
J. M. Young.
Mrs. E. F. Donohue.
J. F. Tompkins.
Mrs. Frederick A. Byrnes.
Charles P. Bushnell.
Mrs. George W. Lane.

The contributions included a $330 Holiday Fund, which was solicited by Mrs. Frederick A. Byrnes and Miss Mary Richards of Norwich.

The Private Benefactors of Shelton Sanatorium.

Mrs. Anne E. Bassett, 70 North Cliff St., Ansonia, Conn., American flag for institution.

Moving picture machine entertainment by employees of S. Blumenthal & Co., Shelton, arranged by Mrs. Bassett.

Flowers at Easter time.

Books for library.

Magazines off and on throughout two years, for patients.

At Christmas time, electric light bulbs for Christmas trees, favors for patients' trays and dining room; also sleeping caps and socks for patients.

Through the kindness of Mrs. Bassett, and the following, Victrola was donated to the Women's Infirmary: Mr. Charles F. Bliss, Ansonia; Mr. and Mrs. George C. Bryant, 75 North Cliff St., Ansonia; Mrs. David Bowen, 5 Clover St., Ansonia; Miss Mary F. Brodie, Elizabeth St., Derby; Mr. Frank M. Clark, Birmingham National Bank, Derby; Mr. William A. Cowles, Ansonia, Conn.; Mrs. Franklin Farrel, Tower Hall, Ansonia; Mrs. E. F. Goss; Mr. Edward McQuade, Ansonia; Miss Margaret McLean, Woodbridge Ave., Ansonia; Mrs. Rutherford Trowbridge, 46 Hillhouse Ave., New Haven; Mrs. Charles van Riper, Garden St., Ansonia.

Clothing—Mr. Jonathan Godfrey, Bridgeport; Mrs. C. R. Worthen,

2340 North Ave., Bridgeport; Mrs. Sarah E. Ferris, 31 Glenwood Ave., Bridgeport; Needlework Guild of America, Bridgeport (clothing and books), The ladies of the Huntington Congregational Church (bed socks), Sunshine Society of Ansonia, Derby and Shelton (Mrs. Cook), (socks, slippers, hoods and underwear), Mrs. C. H. Cook, 55 Bridgeport Ave., Shelton (socks and other clothing).

Repairs to graphophone free of charge, American Graphophone Co., Bridgeport.

Bench at entrance of Sanatorium, Howard & Barber Co., Derby.

Graphophone records—Mrs. R. H. Hubbell, Hotel Taft, New Haven; Miss Edna Palmer, Cos Cob, Conn.; Mr. John J. Ready, Wissner Piano Co., Ansonia.

Plants and flowers—Mrs. R. H. Hubbell, Hotel Taft, New Haven; Mrs. Henry R. Kaiser, 34 Mott St., Ansonia; St. Rose Guild of St. Mary's Church, New Haven (Easter flowers); W. C. T. U., Stratford, Conn. (Mrs. H. L. Hart, president).

Books and magazines—Mrs. C. H. Nettleton, Derby, Conn.; Mrs. Ellsworth Handy, South End, Shelton; Mr. and Mrs. George C. Bryant, 75 North Cliff St., Ansonia; Mrs. Fay, Derby, Conn.

Favors, candy and pop-corn balls—Mrs. Rutherford Trowbridge, 46 Hillhouse Ave., New Haven (pop-corn balls); Mrs. George C. Bryant, 75 North Cliff St., Ansonia (favors); Miss M. E. Lathrop, 31 Atwater Ave., Derby (Christmas candy and cards).

Services—Rev. N. B. Prindle, Shelton (illustrated lecture); Rev. E. B. Schmitt, Ansonia (services); Rev. E. E. Gates, Ansonia (services); Rev. F. S. Morehouse, Shelton (serices); Rev. Charles M. King, Stratford (serices).

Sanatorium Employees.

In compliance with Section 185 of the General Statutes, we append the following list of employees at the various sanatoria, whose compensation is not less than $450.00 per annum:

Meriden Sanatorium Employees.

Superintendent, $2,500.00 with board for self and family.
Resident Physician, $1,000.00 with board for self and family.
Head Nurse, $900.00 with board.
Steward, $900.00 with board.
Two nurses, $600.00 with board.
Four nurses, $540.00 with board.
Four nurses, $480.00 with board.
Bookkeeper, $600.00 with board.
Teacher, $480.00 with board.
Chef, $1,200.00 without board.
Watchman, $480.00 with board.
Engineer, $720.00 with board.
Carpenter, $840.00 with board.
Painter, $480.00 with board.

SHELTON SANATORIUM.

Superintendent, $2,300.00 with board for self and family.
Resident Physician, $900.00 with board for self and family.
Head Nurse, $900.00 with board.
Two nurses, $600.00 with board.
Three nurses, $540.00 with board.
Six nurses, $480.00 with board.
Secretary, $660.00 with board.
Stenographer, $480.00 with board.
Chef, $1,200.00 with board.
Superintendent of buildings and grounds, $1,820.00 with board.
Pastry cook, $660.00 with board.
Steward, $720.00 with board.
Watchman, $660.00 with board.
Farmer, $720.00 with board.
Engineer, $840.00 with board.
Poultry man, $720.00 with board.
Kitchen man, $540.00 with board.
Farm hand, $600.00 with board.
Fireman, $540.00 with board.
Carpenter, $480.00 with board.

HARTFORD SANATORIUM.

Superintendent, $2,200.00 with board for self and family.
Resident Physician, $900.00 with board for self and family.
Head Nurse, $900.00 with board.
Housekeeper, $900.00 with board.
Bookkeeper, $660.00 with board.
Teacher, $600.00 with board.
Stenographer, $480.00 with board.
Two nurses, $540.00 with board.
Seven nurses, $480.00 with board.
Chef, $1,140.00 with board.
Pastry cook, $660.00 with board.
Second chef, $480.00 with board.
Waiter, $480.00 with board.
Fireman, $480.00 with board.
Carpenter, $480.00 with board.
Chauffeur, $480.00 with board.
Farmer, $960.00 with board.

Engineer, $960.00 with board.
Laborer, $540.00 with board.
Two laborers, $480.00 with board.

NORWICH SANATORIUM.

Superintendent, $2,400.00 with board for self and family.
Resident Physician, $900.00 with board for self and family.
Head Nurse, $780.00 with board.
Three nurses, $600.00 with board.
Three nurses, $540.00 with board.
Four nurses, $480.00 with board.
Housekeeper, $720.00 with board.
Bookkeeper, $720.00 with board.
Chef, $900.00 with board.
Assistant chef, $480.00 with board.
Janitor, $600.00 with board.
Farmer, $1,200.00 without board.
Carpenter, $720.00 with board.
Laborer, $1,305.45 without board.
Two laborers, $1,368.75 without board.
Teamster, $1,335.90 without board.
Watchman, $1,186.25 without board.

Financial Report of the Meriden State Sanitorium.

DR. JAMES B. DINNAN.....*Superintendent*
DR. THOS. F. O'BRIEN.....*Assistant Physician*
MISS MAUDE M. WHITE.....*Head Nurse*
MISS IRENE M. HAVENS.....*Secretary*
EDWARD F. TRACY.....*Steward*

REPORT FOR THE YEARS ENDING, SEPTEMBER 30, 1917, AND FOR SEPTEMBER 30, 1918.

Institution Receipts:	Years 1916-17	1917-18	
Board of Patients:			
Towns and cities	$19,375 35	$15,349 61	
Associations	4,828 72	5,937 24	
Individuals	3,301 67	3,603 21	
	$27,505 74	$24,890 06	
Total receipts for board, October 1, 1916-September 30, 1918...			$52,395 80
Miscellaneous receipts:			
Clothing	$ 740 83	$ 305 16	
Telephone and stamps	17 62	11 48	
Sales of grease	81 07	39 32	
Sales of gasolene	140 24	100 00	
Miscellaneous sales	25 00	51 65	
	$1,004 76	$507 61	
Total miscellaneous receipts October 1, 1916-September 30, 1918			$1,512 37
To bills of institution paid by State Tuberculosis Commission:			
Construction		$ 4,476 20	
Equipment	$ 150 00	3,625 75	
Maintenance	81,354 06	86,835 73	
	$81,504 06	$94,937 68	
Total of all bills paid by State Tuberculosis Commission October 1, 1916-September 30, 1918			$176,441 74
Cash book balance October 1, 1916			3,848 94
Total receipts from all sources			$234,198 85

PAYMENTS.

	Years 1916-17	1917-18
To Secretary of State Tuberculosis Commission	$30,270 40	$24,834 43

Sundries Account:			
Refunds	130 98	151 21	
Clothing	881 49	305 16	
Miscellaneous	470 91	8 11	
	$31,753 78	$25,298 91	
Total			$57,052 69
Bills paid by check of State Tuberculosis Commission	$81,504 06	$94,937 68	176,441 74
Cash book balance October 1, 1918			704 42
Total			$234,198 85

Resources and Liabilities.

Resources.

	Oct. 1, 1917	Oct. 1, 1918	
Cash on hand and in bank	$605 19	$704 42	
Bills due on patients' board:			
Towns and cities	890 19	952 45	
Associations	47 42	361 38	
Individuals	239 64	194 71	
	$1,782 91	$2,212 96	
Total			$3,995 87

Liabilities.

Due State Tuberculosis Commission from institution as per resources	$3,995 87

Analysis of Expenses.

Construction account:			
Root cellar		$ 729 00	
Glass sash		2,680 00	
Additional store-room		1,067 20	
		$4,476 20	
Total			$4,476 20
Equipment account:			
Auto account		$ 648 75	
Miscellaneous equipment		2,977 00	
Furniture	$150 00		
	$150 00	$3,625 75	
Total			$3,775 75

MAINTENANCE.

	Years 1916-18	1917-18	
Salaries, wages and labor:			
General administration and office ..	$ 9,503 93	$10,146 30	
Medical services	10,029 59	9,938 66	
Farm, stable and grounds	2,996 10	3,485 53	
	$22,529 62	$23,570 49	
Total			$46,100 11
Food:			
Meat	$13,384 83	$11,269 27	
Eggs	2,848 60	2,976 38	
Butter	2,043 16	2,777 72	
Milk	7,264 40	7,769 19	
Fish	805 56	786 97	
Flour	2,169 00	594 06	
Sugar	568 69	623 37	
Vegetables	1,798 30	1,850 30	
Fruit	209 55	183 54	
Canned goods	1,359 95	3,236 54	
Tea and coffee	682 93	335 54	
Miscellaneous	2,324 76	3,896 01	
	$35,459 73	$36.298 89	
Total			$71,758 62
Light, heat and power:			
Coal	$3,492 79	$5,813 21	
Electric light	1,531 77	1,588 04	
Gasolene, oil and wood	666 14	646 20	
Pump engine repairs	119 36	466 09	
Gas	1,031 30	1,476 60	
Electric power	400 42	457 76	
	$7,241 78	$10,447 90	
Total			$17,689 68
Farm, stable and grounds:			
Carriage and harness repairs	$ 60 95	$ 35 95	
Horses	386 96	204 56	
Automobile	611 19	497 42	
Sundries		51 24	
	$1,059 10	$789 17	
Total			$1,848 27
Repairs to buildings:			
Buildings	$1,329 98	$553 08	
Plumbing	534 80	838 28	
Grounds	489 10		
Sterilizer	95 97	454 20	

Refrigerating plant	90 07	329 48	
Painting	165 50	276 51	
	$2,705 60	$2,452 55	
Total			$5,156 97
Repairs and replacement of equipment:			
Repairs to fixtures	$ 18 01	$ 34 04	
Furniture	17 10	7 70	
Bedding and linen	1,010 45	793 51	
Crockery and silverware	16 75	153 24	
Miscellaneous equipment	116 25	119 87	
	$1,178 56	$1,108 36	
Total			$2,286 92
Miscellaneous:			
Telephone and telegraph	$ 401 44	$ 348 88	
Printing and stationery	124 99	129 19	
Transportation	357 27	383 80	
Laundry	4,657 81	4,257 37	
Insurance	444 66	543 33	
Miscellaneous office account	411 68	806 21	
Housekeeping supplies	1,328 52	1,297 84	
Hospital supplies	1,446 55	1,937 46	
Medicines	900 42	1,007 55	
Water	860 43	742 26	
Sundries	171 38		
Sewer		392 94	
School supplies	74 70	138 29	
Dentistry and other hospital		184 25	
	$11,179 85	$12,169 37	
Total			$23,349 22
Total expense for maintenance			$176,441 74

MAINTENANCE RESOURCES.

	Years 1916	1917-18	
Goods on hand:			
Fuel	$100 00	$1,575 00	
Stockroom	400 00	4,775 45	
Drugs	120 00	150 00	
	$620 00	$6,500 45	
Total			$7,120 45

PER CAPITA.

Recapitulation and per capita:			
Stock on hand October 1, 1916	$ 979 47	$ 620 00	
Total maintenance	81,504 06	86,835 73	
	$82,483 53	$87,455 73	

Stock on hand October 1, 1917	620 00	6,500 45	
	$81,863 53	$80,955 28	
Actual maintenance total			$162,818 81
Total number of hospital days	44,552	42,422	
Cost per patient per day	$1.837	1.908	
Cost per patient per week	12.859	13.35	
Average per week for two years			13.104

VALUATIONS.

Thirty and one-quarter acres land	$ 6,755 00
Infirmary building with connecting passageway	33,000 00
Two-story forty-bed shack	8,900 00
Dining hall	11,000 60
One-story twenty-four-bed shack	15,800 00
Nurses' home	31,000 00
Store room	2,000 00
Barn	3,500 00
Superintendent's cottage	5,800 00
Shed	550 00
Fire escape	750 00
Water tank	1,390 00
Pump house	1,000 00
Refrigerating plant	2,679 06
Screens and awnings	3,000 00
Glass sash	2,680 00
Horses and wagons	400 00
Automobile	648 75
Bedding	4,200 00
Crockery and glassware	2,100 00
Fire hose and extinguisher	536 00
Furniture and upholstery	6,007 70
Kitchen and household wares	2,000 00
Housekeeping supplies	3,000 00
Coal	1,575 00
Oil	80 00
Food supplies on hand	3,316 93
Fur coats	1,000 00
Steam cooking apparatus	991 00
Steam tables	357 50
Meat grinder	156 75
Laboratory	285 65
Incinerator	1,735 00
Total	$158,194 34

Financial Report of the State Tuberculosis Sanitorium at Shelton.

DR. EDWARD J. LYNCH.....*Superintendent*
DR. HENRY J. SCHROEDER.....*Resident Physician*
MISS CATHERINE R. KESSACK.....*Head Nurse*
RALPH B. ROGERS.....*Secretary*
GEORGE B. LUCID.....*Steward*
CARL O. H. JOHNSON.....*Engineer*

REPORT FOR YEARS ENDING SEPTEMBER 30, 1917, AND SEPTEMBER 30, 1918.

Cash Account.

Institution Receipts:	Years 1916-17	1917-18	
Board of patients:			
Towns and cities	$10,294 45	$8,022 23	
Associations	4,931 60	4,564 72	
Private patients	6,387 50	5,800 86	
	$21,613 55	$18,387 81	
Total receipts for board, October 1, 1916-September 30, 1918....			$40,001 36
Miscellaneous receipts:	Years 1916-17	1917-18	
Miscellaneous sales	95 08	$126 31	
Telephone and telegrams	14 32	12 94	
Scrap meat	21 57	64 74	
	$130 97	$203 99	
Total miscellaneous receipts, October 1, 1916-September 30, 1918			$334 96
To bills of institution paid by State Tuberculosis Commission:	Years 1916-17	1917-18	
Construction	$ 4,471 60	$72,467 97	
Maintenance	76,120 42	74,231 99	
Equipment	1,340 04	7,700 32	
	$81,932 06	$154,400 28	
Total of all bills paid by State Tuberculosis Commission, October 1, 1916-September 30, 1918			$236,332 34
Received on outstanding accounts			1,945 16
Total receipts from all sources			278,613 82
Cash on hand October 1, 1916			2,496 62
Grand total of all receipts			$281,110 44

PAYMENTS.

	Years 1916-17	1917-18	
To Secretary of State Tuberculosis Commission, patients' board	$25,072 66	$15,966 05	
To Secretary of State Tuberculosis Commission, miscellaneous account	144 76	203 99	
To refunds, patients' board	158 19	249 62	
Outstanding accounts, checks not received from Secretary		1,942 54	
Outstanding accounts, checks not received from Comptroller		28 23	
Bills paid by checks of State Tuberculosis Commission	81,932 06	154,400 28	
Cash book balance October 1, 1918		1,012 06	
	$107,307 67	$173,802 77	
Total expenditures October 1, 1916-September 30, 1918			$281,110 44

RESOURCES AND LIABILITIES.

Resources.

Cash on hand October 1, 1918	$ 328 79	
Balance in bank	683 27	
Bills due from towns and cities	1,148 97	
Bills due from associations	754 02	
Bills due from private patients	372 15	
Payroll and office account (due from Commission office)	1,942 54	
Due from Comptroller	28 23	
	$5,257 97	

Liabilities.

Due State Tuberculosis Commission from institution as per resources	$5,257 97

ANALYSIS OF EXPENSES.

	Years 1916-17	1917-18	
Construction:			
Superintendent's cottage	$4,471 60		
Addition to infirmary		$53,645 79	
Shack alterations		7,928 16	
Glass sash		2,529 00	
Incinerator		895 00	
Stable		533 02	
Dining room		700 00	
Alteration nurses' home		3,000 00	
Recreation hall		2,500 00	
Water supply		737 00	
	$4,471 60	$72,467 97	
Total			$76,939 57

Miscellaneous equipment:			
Superintendent's cottage—			
Screens	$290 00		
Furniture	560 55		
Linen and bedding	21 20		
Crockery and silverware	83 64		
Curtains	166 86		
Rugs	196 55		
Fixtures	21 60		
Body for auto truck		$ 167 25	
Fire protection		354 29	
Plumbing		40 88	
Fixtures		11 23	
Linen and bedding		2,010 25	
Auto truck		691 14	
Plumbing supplies		964 53	
	$1,340 40	$4,239 57	
Total			$5,579 97
Infirmary equipment:			
Shades		$ 138 00	
Transportation		28 23	
Silverware		117 50	
Beds		834 00	
Bedding		801 00	
Dishes		116 50	
Furniture		1,245 20	
Hospital supplies		180 32	
Total		$3,460 75	

MAINTENANCE.

Salaries, wages and labor:			
General, administration and office	$ 9,768 78	$9,086 10	
Medical services	11,286 53	9,775 76	
Farm, stable and grounds	5,445 48	5,094 15	
	$26,500 79	$23,956 01	
Total			$50,456 80
Food:			
Meat	$8,014 96	$6,527 70	
Eggs	1,364 70	1,039 20	
Butter	1,544 24	1,637 33	
Milk	6,463 86	5,827 08	
Fish	448 51	607 20	
Flour	2,507 12	204 89	
Sugar	821 55	522 34	
Vegetables	1,286 58	426 41	
Fruit	377 08	203 75	

Canned goods	1,974 29	2,839 97	
Tea and coffee	494 43	218 50	
Miscellaneous	1,652 78	2,181 85	
	$26,950 10	$22,236 22	
Total			$49,186 32
Light, heat and power:			
Coal	$5,787 44	$8,132 72	
Electric light	1,188 81	1,292 61	
Pump and engine repairs	200 62		
Electric power	476 90	574 97	
Refrigerator	158 31	126 25	
	$7,812 08	$10,126 55	
Total			$17,938 63
Farm, stable and grounds:			
Poultry	$1,377 60	$1,688 61	
Carriage and harness repairs	52 50	19 20	
Horses	549 37	620 16	
Farming tools	28 40	97 25	
Fertilizer and seeds	246 66	372 10	
Sundries	22 56	80 51	
Auto truck		254 16	
	$2,277 09	$3,131 99	
Total			$5,409 08
Repairs to buildings and grounds:			
Buildings	$214 27	$1,285 62	
Plumbing	136 33	187 04	
Heating	159 58	105 99	
Sewers		33 90	
Grounds	152 20	107 15	
	$662 38	$1,719 70	
Total			$2,382 08
Repairs and replacement of equipment:			
Repairs to fixtures	$396 71	$ 272 59	
Furniture	20 75	22 50	
Bedding and linen	739 55	1,000 42	
Crockery and silverware	266 40	200 24	
Kitchen furnishings	83 91	162 93	
Miscellaneous equipment		14 00	
	$1,507 32	$1,672 68	
Total			$3,180 00
Miscellaneous			
Telephone and telegraph	$ 453 10	$ 416 53	
Printing and stationery	245 39	509 61	

Transportation	269 48	257 56	
Laundry	4,555 64	4,212 01	
Mechanics' supplies	28 62	63 17	
Dentistry		10 00	
Insurance and bonding	824 28	2,103 15	
Miscellaneous office expense	120 60	118 37	
Housekeeping supplies	974 46	930 19	
Hospital supplies	2,536 78	2,105 63	
Medicine	340 29	662 62	
Professional services	60 00		
Sundries	2 02		
	$10,410 66	$11,388 84	
Total			$21,799 50
Total expenses for maintenance			$150,352 41

MAINTENANCE RESOURCES.

Goods on hand:	Oct. 1, 1917	Oct. 1, 1918
Fuel	$1,553 10	$1,863 00
Stock room	3,654 26	3,132 50
Drugs and hospital supplies	1,019 00	939 36
Farm products	1,924 90	1,310 54
	$8,151 26	$7,245 40

PER CAPITA.

Recapitulation and per capita:			
Stock on hand Oct. 1, 1916	$ 3,643 48	(10-1-17)	$ 8,151 26
Maintenance expense 1916-17	76,120 42	(17-18)	74,231 99
	$79,763 90		$82,383 25
Stock on hand Oct. 1, 1917	8,151 26	(10-1-18)	7,245 40
Actual maintenance expense	$71,612 64		$75,137 85
Total number of hospital days	36,963	31,808	
Cost per patient per day	$1.937	$2.362	
Cost per patient per week	13.559	16.434	
Average for two years		14.997	

VALUATIONS.

Land	$ 28,517 00
Sewer	10,695 33
Infirmary	120,030 00
Cottage No. 1	12,000 00
Cottage No. 2	9,500 00
Cottage No. 3	525 00
Shacks Nos. 1 and 2, dining hall and runs	50,674 00
Women's shack	13,500 00
Recreation hall and help's quarters	6,500 00
Superintendent's cottage	12,000 00

Disinfecting room and morgue	1,198 00	
Pumping stations	3,000 00	
Water tower and pipe	3,100 00	
Carriage house and workshop	200 00	
Incinerator	895 00	
Poultry department	3,800 00	
Barn and stable	1,500 00	
Auto truck	816 00	
Horses	450 00	
Other live stock	1,575 00	
Equipment of all	28,000 00	
Coal in stock	1,863 00	
Drugs and hospital supplies	939 36	
Storeroom inventory	3,132 50	
Vegetables and farm produce	1,310 54	
Total	$315,720 73	

REPORT OF THE FARM.

October 1, 1916, to September 30, 1917.

Inventory October 1, 1917:		
Buildings, including root cellar (1916 value less 20%)	$1,460 00	
Horses	450 00	
Harness	120 00	
Wagons and carriages	217 00	
Stable goods, etc.	54 25	
Farm tools and implements	276 85	
		$2,578 10
Products delivered to sanatorium:		
Potatoes at market price	$1,260 00	
Vegetables at market price	664 90	
Fruit at market price	10 00	
Hay at market price	270 00	
Straw at market price	52 00	
Vinegar at market price	72 00	
Wood at market price	100 00	
Services rendered team	600 00	
Sales:		
Produce outside	50 00	
Miscellaneous	13 50	
		$3,092 40
		$5,670 50
Expenses:		
Labor	$1,000 61	
Fertilizer and seeds	246 66	
Horses (feed, etc)	549 37	
Farm tools	28 40	

Carriage and harness repairs	52 50	
Sundries	22 56	
Total expenses	$1,900 10	
Inventory Oct. 1, 1916	3,181 15	
		$5,081 25
Gain		$589 25

October 1, 1917, to September 30, 1918.

Inventory October 1, 1918:		
Buildings	$1,993 00	
Horses	450 00	
Harness	150 00	
Wagons and carriages	217 00	
Stable goods, etc.	85 60	
Farm tools and implements	374 10	
		$3,269 70
Products delivered to sanatorium:		
Potatoes at market price	$1,235 00	
Vegetables at market price	446 82	
Hay at market price	320 00	
Services rendered team	600 00	
Sales:		
Produce outside	1 50	
		$2,603 32
Total receipts		$5,873 02
Expenses:		
Improvements to barn and stable	$ 535 02	
Labor	1,751 75	
Fertilizer and seeds	372 10	
Horses, feed, etc.	620 16	
Farm tools	28 40	
Carriage and harness repairs	19 20	
Sundries	80 51	
	$3,407 14	
Inventory Oct. 1, 1917	2,578 10	
		$5,985 24
Loss		$112 22

POULTRY REPORT.

October 1, 1916, to September 30, 1917.

Inventory October 1, 1917:		
Buildings, yards, utensils, etc.		$3,680 00
Stock:		
625 hens @ $1.50	$937 50	
317 chickens @ $1.50	475 50	
		$1,413 00
Total inventory		$5,093 00

Income (delivered to sanatorium):		
Eggs, 3,390 doz. @ .35 per doz.	$1,186 68	
Chicken, 2,015½ lbs. @ .30 per lb.	628 95	
Ducks, 337 lbs. @ .30 per lb.	101 10	
Eggs saved for hatching, 191 2-3 doz. @ .35 per doz.	67 08	
		$1,983 81
Total receipts		$7,076 81
Expenditures:		
Labor	$ 600 00	
Feed and supplies	1,377 60	
	$1,977 60	
Inventory Oct. 1, 1916	$5,051 00	
		$7,028 60
Gain		$48 21

October 1, 1917, to September 30, 1918.

Inventory October 1, 1918:		
Buildings, yards, utensils, etc.		$3,800 00
250 yearlings @ $1.50	$ 375 00	
800 young chickens @ $1.50	1,200 00	
		1,575 00
Total inventory		$5,375 00
Income (delivered to sanatorium):		
Eggs, 2,966 doz. @ .49 per doz.	$1,453 34	
Chickens, 2,387 lbs. @ 35c. per lb.	835 45	
Eggs saved for hatching, 198 doz. @ .49	97 02	
		2,385 81
Total receipts		$7,760 81
Expenditures:		
Labor	$ 720 00	
Feed and supplies	1,688 61	
	$2,408 61	
Inventory Oct. 1, 1917	5,093 00	
		7,501 61
Gain		$259 20

Financial Report of the State Tuberculosis Sanatorium at Hartford.

DR. POSEPH E. STROBEL.....*Superintendent*
MISS KATHLEEN REEN.....*Head Nurse*
MISS MARY RIORDAN.....*Secretary*
MISS NINA DELL.....*Stenographer*
MISS MARY B. KEYS.....*Housekeeper*
MISS ELISABETH LIGHTFOOT.....*Teacher*
EDWARD AGARD .....*Engineer*

REPORT FOR YEARS ENDING SEPTEMBER 30, 1917, AND SEPTEMBER 30, 1918.

Cash Account.

Institution Receipts:	Year 1916-17	1917-18	
Board of patinets:			
Towns	$23,935 07	$21,842 22	
Associations	5,315 02	5,773 64	
Individuals	7,000 71	5,729 67	
	$36,250 80	$33,345 53	
Total receipts for board, Oct. 1,1916-Sept. 30, 1918			$69,596 33
Miscellaneous receipts:			
Clothing	$ 480 68	$ 600 31	
Miscellaneous sales	203 07	1,305 64	
	$ 683 75	$ 1,905 95	
Total miscellaneous receipts, Oct. 1, 1916-Sept. 30, 1918			2,589 70
To bills of institution paid by State Tuberculosis Commission:			
	Year 1916-17	1917-18	
Construction		$ 5,275 49	
Equipment	$ 1,037 20	1,646 93	
Maintenance	103,309 12	104,867 91	
	$104,346 32	$111,790 33	
Total of all bills paid by State Tuberculosis Commission			$216,136 65
Cash on hand, October 1, 1916			2,114 27
Total receipts from all sources			$290,436 95

Payments.

	Year 1916-17	1917-18
To Secretary of State Tuberculosis Commission:		
Patients' board	$36,893 92	$34,046 28
Miscellaneous sales	203 07	2,305 64
Purchase of clothing	604 67	600 73

Bills paid by State Tuberculosis Commission	104,346 32	111,790 33	
Cash on hand, October 1, 1918		645 99	
	$142,047 98	$148,388 97	
Total expenditures, Oct. 1, 1916-Sept. 30, 1918			$290,436 95

RESOURCES AND LIABILITIES.

Resources.

Cash on hand October 1, 1918	$ 645 99	
Accounts receivable:		
Towns and cities	2,914 76	
Associations	1,071 24	
	$4,631 99	
Less advance payment on patients' board	94 56	
		$4,537 43

Liabilities.

Due State Tuberculosis Commission from institution as per resources	$4,537 43

ANALYSIS OF EXPENSES.

	Years 1916-17	1917-18	
Equipment, not including replacement of any kind:			
Auto truck		$ 698 65	
Stalls in shacks		240 00	
Hot beds		50 00	
Plumbing in shacks		658 28	
Linen and bedding	$953 75		
Tools and implements	83 45		
	$1,037 20	$1,646 93	
Total			$2,684 13
Construction:			
Glass sash		$1,920 66	
Poultry plant		1,537 40	
Root cellar		986 19	
Alteration to shacks		112 00	
Sewage plant		719 24	
Total			$5,275 49
Total expenses for equipment and construction			$7,959 62

MAINTENANCE.

	Years 1916-17	1917-18	
Salaries, wages and labor:			
General administrative and office	$13,447 04	$13,504 28	
Medical services	15,496 92	14,569 21	
Farm, stable and grounds	3,134 42	4,080 89	
	$32,078 38	$32,154 38	
Total			$64,232 76

Food:			
Meat	$12,004 16	$11,714 19	
Butter	2,678 20	2,845 50	
Eggs	3,315 83	4,034 54	
Milk	11,284 71	10,832 80	
Fish	527 38	1,196 22	
Flour	2,504 26	1,586 00	
Sugar	779 15	894 70	
Vegetables	2,898 65	1,325 87	
Fruit	633 74	650 31	
Canned goods	3,763 64	4,045 09	
Tea and coffee	652 60	363 50	
Miscellaneous	2,642 37	2,825 05	
	$43,684 69	$42,313 77	
Total			$85,998 46
Light, heat and power:			
Coal	$4,721 60	$9,482 86	
Electric lights	1,055 25	1,210 23	
Gasoline, oil and wood	491 95	757 86	
Pump and engine repairs	35 88	146 43	
Electric power	781 91	1,173 38	
	$7,086 59	$12,770 76	
Total			$19,857 35
Farm, stable and grounds:			
Carriage and harness repair	$ 154 25	$ 387 15	
Horses	672 31	750 89	
Fertilizers	410 70	627 35	
Sundries	457 75	283 42	
Auto	1,049 62	1,507 50	
Farm tools	43 29	74 40	
	$2,787 92	$3,630 71	
Total			$6,418 63
Repairs to buildings and grounds:			
Buildings	$460 21	$137 03	
Plumbing	441 51	304 59	
Heating	428 73	209 34	
Water	88 54		
Sewer	19 67		
Grounds	499 42	113 02	
	$1,938 08	$763 98	
Total			$2,702 06
Repairs and replacements of equipment:			
Repairs to fixtures	$ 168 71	$ 449 18	
Furniture	71 10	76 51	
Bedding and linen	1,728 40	1,504 44	

Crockery and silverware	262 81	337 22	
Kitchen furnishings	203 62	240 15	
Medical equipment	199 97	52 83	
Miscellaneous	8 00	116 93	
	$2,642 61	$2,777 26	
Total			$5,419 87
Miscellaneous:			
Telephone and telegraph	$ 445 57	$ 354 73	
Printing and stationery	306 67	597 14	
Transportation	171 24	89 97	
Clothing for patients	29 67		
Laundry	4,075 40	4,832 49	
Mechanics' supplies	36 38	18 70	
Insurance and bonding	1,541 85	91 04	
Other hospitals	255 00	58 00	
Miscellaneous office expense	300 95	469 94	
Housekeeping supplies	1,631 08	903 42	
Hospital supplies	2,622 93	1,414 69	
Medicine	537 72	632 94	
Water	1,026 80	973 92	
Sundries	77 11	12 45	
School	32 36	7 62	
	$13,090 85	$10,457 05	
Total			$23,547 90
Total expenses for maintenance			$208,177 03

Financial Report of the State Tuberculosis Sanatorium at Norwich.

DR. HUGH BAIRD CAMPBELL.....*Superintendent*
DR. EDWARD F. SULLIVAN.....*Resident Physician*
MISS MARY A. SMALL.....*Head Nurse*
MISS MIRIAM M. CAMPBELL.....*Housekeeper*
MISS CLARA M. CHRISTOPH.....*Secretary*

REPORT FOR YEARS ENDING SEPTEMBER 30, 1917, AND SEPTEMBER 30, 1918.

CASH ACCOUNT.

Institution Receipts:	Years 1916-17	1917-18	
Board of patients:			
Towns	$6,101 05	$4,545 15	
Associations	2,634 51	3,997 48	
Private	8,868 09	10,179 46	
	$17,603 65	$18,722 09	
Total receipts for board Oct. 1, 1916-Sept. 30, 1918			$36,325 74
Miscellaneous receipts:			
Telephone, farm products, guinea pigs, etc.	$327 76	$182 98	
Total miscellaneous receipts Oct. 1, 1916-Sept. 30, 1918			510 74
To bills of institution paid by State Tuberculosis Commission:			
Maintenance	$64,758 70	$74,894 91	
Equipment	8 00	2,996 53	
Construction		36,375 82	
	$64,766 70	$114,267 26	
Total of all bills paid by State Tuberculosis Commission			179,033 96
Cash due from State Tuberculosis Commission:			
Weekly payroll, Sept. 30, 1916			228 35
Monthly payroll, Sept. 30, 1916			1,177 60
Office account, Sept. 30, 1916			98 18
Cash on hand Sept. 30, 1916			1 50
Total receipts from all sources			$217,376 07

PAYMENTS.

	Years 1916-17	1917-18
To Secretary, State Tuberculosis Commission	$18,884 44	$18,801 20
Bills paid by State Tuberculosis Commission	64,766 70	114,267 26
Due from State Tuberculosis Commission:		
Weekly payroll		10 50
Office account		6 01

Due from Comptroller, weekly payroll..		78 00	
Refunds on patients' board	133 14	226 78	
Cash on hand Sept. 30, 1918		202 04	
	$83,784 28	$133,591 79	
Total payments			$217,376 07

RESOURCES AND LIABILITIES.

Resources.

Cash on hand Sept. 30, 1918	$202 04
Bills due from towns and cities (patients' board)	421 98
Bills due from associations (patients' board)	327 71
Bills due from private patients (patients' board)	9 01
	$960 74

Liabilities.

Due State Tuberculosis Commission from institution as per resources	$960 74

ANALYSIS OF EXPENSES.

New equipment, not including replacement of any kind:

	Years 1916-17	1917-18	
Fixtures		$ 83 00	
Furniture	$8 00	133 80	
Linen and bedding		1,329 00	
Crockery and glassware		197 25	
Medical and sanitary		75 00	
Tools and implements		6 00	
Vehicles and harness		167 25	
Sundries		351 74	
Auto appropriation		653 49	
	$8.00	$2,996 53	
Total			$3,004 53

Construction:	Years 1917-18	
Isolation rooms	$6,799 13	
Glass sash	855 00	
Barn (insurance fund)	3,280 34	
Superintendent's cottage	5,382 95	
New infirmary	19,226 40	
Incinerator	832 00	
Total		$36,375 82

MAINTENANCE.

	Years 1916-17	1917-18	
Salaries, wages and labor:			
General administrative and office ..	$9,625 20	$11,104 83	
Medical service	9,191 90	10,000 74	
Farm, stable and outside	3,100 71	3,913 67	
	$21,917 81	$25,019 24	
Total			$46,937 05

Food:			
Meat	$6,473 12	$7,079 63	
Eggs	1,259 76	1,517 38	
Butter	1,310 60	1,840 47	
Milk	5,893 53	6,330 42	
Fish	391 33	963 47	
Flour	1,436 26	781 90	
Sugar	588 50	369 58	
Vegetables	508 44	290 56	
Fruit	609 95	475 43	
Canned goods	1,668 13	3,668 51	
Tea and coffee	416 75	258 45	
Miscellaneous	2,388 83	2,403 13	
	$22,945 20	$25,978 93	
Total			$48,924 13
Light, heat and power:			
Coal	$4,149 91	$8,044 13	
Electric light	835 17	1,015 77	
Electric power	179 90	181 00	
Coke	21 75		
	$5,186 73	$9,240 90	
Total			$14,427 63
Farm, stable and grounds:			
Carriage and harness repairs	$ 19 90	$130 74	
Horses	268 15	548 26	
Farming tools	52 72	66 52	
Fertilizer	485 85	410 93	
Sundries	85 41	274 11	
Guinea pigs	70 45	3 00	
	$982 48	$1,433 56	
Total			$2,416 04
Repairs to buildings and grounds:			
Buildings	$415 11	$407 04	
Plumbing	167 22	216 09	
Heating	11 55		
Water	27 14		
Grounds	95 35	270 30	
Sewers	188 95	147 07	
Incinerator	26 50	18 73	
	$931 82	$1,059 23	
Total			$1,991 05
Repairs and replacement of equipment:			
Repairs to fixtures	$ 353 54	$717 10	
Furniture	90 79	133 20	
Bedding	1,669 72	175 17	

Crockery and silverware	98 85	279 15	
Kitchen furnishing	221 80	140 14	
Medical equipment	22 00		
Miscellaneous equipment	391 36	35 78	
	$2,848 06	$1,480 54	
Total			$4,328 60
Miscellaneous:			
Telephone and telegraph	$ 367 43	$ 357 02	
Printing and stationery	186 48	59 10	
Transportation	273 35	294 58	
Laundry	3,730 04	4,550 35	
Dentistry	70 00	50 00	
Insurance	22 50	227 70	
Other hospitals		22 50	
Miscellaneous office expense	236 77	242 94	
Housekeeping supplies	614 31	847 41	
Hospital supplies	3,231 74	2,484 98	
Medicines	976 89	1,093 65	
Water	55 59	97 10	
Sundries	181 50	355 18	
	$9,946 60	$10,682 51	
Total			$20,629 11
Total maintenance			$139,653 61

MAINTENANCE RESOURCES.

Goods on hand:	Years 1916-17	1917-18
Fuel	$ 770 25	$5,062 50
Stockroom	5,082 86	7,423 36
Bedding and linen	1,790 91	2,550 19
Drugs	441 78	757 68
Farm products	1,322 44	1,187 00
Total	$9,408 24	$16,980 73

PER CAPITA.

Recapitulation and per capita:			
Stock on hand Oct. 1, 1916	$ 4,475 86	(10-1-17)	$ 9,408 24
Total maintenance	64,758 70		74,894 91
	$69,234 56		$84,303 15
Stock on hand Oct. 1, 1917	9,408 24	(10-1-18)	16,980 73
Actual maintenance expenses	$59,826 32		$67,322 42
Maintenance, less sales	327 76		182 98
	$59,498 56		$67,139 44

Total number of hospital days	30,044	31,841
Cost per patient per day	$1 98	$2 10
Cost per patient per week	$13 86	$14 70
Average for two years		$14 28

VALUATIONS.

Thirty-one acres	$ 10,000 00	
Buildings	136,300 00	
Live stock and vehicles	1,850 00	
Equipment including beds and bedding, linens, household supplies and farm equipment	35,924 99	
Total		$184,074 99

REPORT OF FARM, 1918.

Products delivered to Sanatorium:		
Vegetables at market prices	$ 571 85	
Potatoes at market prices	1,540 00	
		$2,111 85
Services rendered:		
Team and services		840 00
Sales:		
Produce outside	$51 00	
Guinea pigs	48 00	
		99 80
Total receipts		$3,051 65
Expenses:		
Labor	$1,956 83	
Expenses (farm, stable and grounds)	1,433 56	
		$3,390 39
Farm deficit		$338 74

Medical Report of Four Sanatoria.

TWO YEARS—OCTOBER 1, 1916, TO SEPTEMBER 30, 1917; OCTOBER 1, 1917, TO SEPTEMBER 30, 1918.

TABLE 1—*Population.*

MERIDEN STATE TUBERCULOSIS SANATORIUM.

	1916-17			1917-18		
	Male	Female	Total	Male	Female	Total
Beginning	68	46	114	68	50	118
Admitted	115	71	226	117	59	176
Discharged	86	38	124	79	33	112
Died	71	27	98	47	27	74
Remaining	68	50	118	59	49	108
Daily average	72	49	121	70	50	120

SHELTON STATE TUBERCULOSIS SANATORIUM.

	1916-17			1917-18		
	Male	Female	Total	Male	Female	Total
Beginning	64	37	101	51	32	83
Admitted	146	75	221	111	77	188
Discharged	128	57	185	70	52	122
Died	31	23	54	21	25	46
Remaining	51	32	83	71	32	103
Daily average	65	36	101	56	31	87

HARTFORD STATE TUBERCULOSIS SANATAORIUM.

	1916-17			1917-18		
	Male	Female	Total	Male	Female	Total
Beginning	117	50	167	111	51	162
Admitted	198	124	322	156	92	248
Discharged	120	75	195	121	72	193
Died	84	48	132	48	29	77
Remaining	111	51	162	98	42	140
Daily average	110	48	158	110	49	159

NORWICH STATE TUBERCULOSIS SANATORIUM.

	1916-17			1917-18		
	Male	Female	Total	Male	Female	Total
Beginning	44	42	86	44	40	84
Admitted	72	94	166	87	88	175
Discharged	49	64	113	48	55	103
Died	23	32	55	38	31	69
Remaining	44	40	84	45	42	87
Daily average	43	39	82	44	42	86

Total "died" not included in "discharged."

TABLE 2—*Hospital Days.*

	1916-17	1917-18
October	14,349	13,940
November	14,155	13,410
December	14,542	13,745
January	14,541	13,340
February	13,397	12,335
March	14,500	13,600
April	13,826	13,423
May	14,350	13,940
June	13,769	13,094
July	14,236	14,511
August	14,124	14,775
September	13,468	13,372
Total	169,257	164,085

Total Hospital Days.

	1916-17	1917-18
Meriden Sanatorium	44,552	42,422
Shelton Sanatorium	36,963	31,808
Hartford Sanatorium	57,698	58,014
Norwich Sanatorium	30,044	31,841

Shelton's decrease in hospital days due to "alteration of shacks."

TABLE 3—*Length of Stay of Discharged Patients.*

	1916-17	1917-18
Under 3 months	293	240
3 months to 6 months	144	116
6 months to 1 year	100	97
1 year to 2 years	58	47
2 years and over	22	30
Total	617	530

Length of Stay of Patients Who Died.

	1916-17	1917-18
Under 3 months	157	127
3 months to 6 months	74	58
6 months to 1 year	62	43
1 year to 2 years	30	22
2 years and over	16	16
Total	339	266

TABLE 4—*Condition of Patients on Admission.*

MERIDEN STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Incipient	5	2	4	8	19
Moderately advanced	23	13	33	9	78
Far advanced	119	50	68	39	276
Bone	2	4	5	0	11
Glandular	0	1	2	2	5
Non-tuberculous	1	1	4	1	7
Not treated	5	0	1	0	6
Total	155	71	117	59	402

SHELTON STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Incipient	16	7	10	9	42
Moderately	84	39	95	53	271
Far advanced	43	28	4	14	89
Acute miliary	0	0	0	0	0
Surgical	2	1	2	1	6
Non-tuberculous	1	0	0	0	1
Total	146	75	111	77	409

TABLE 4—*Condition of Patients on Admission.—Continued.*

HARTFORD STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Incipent	6	0	2	4	12
Moderately advanced	39	15	15	12	81
Far advanced	138	97	118	64	417
Acute	0	0	0	0	0
Bone	8	6	10	3	27
Glandular	6	2	10	5	23
Surgical	0	0	0	3	3
Non-tuberculous	0	4	1	1	6
Not treated	1	0	0	0	1
Total	198	124	156	92	570

NORWICH STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Incipient	8	18	9	14	49
Moderately advanced	37	50	42	40	169
Far advanced	26	25	36	33	120
Acute	0	0	0	0	0
Bone	0	0	0	0	0
Glandular	0	1	0	0	1
Non-tuberculous	1	0	0	1	2
Total	72	94	87	88	341

TABLE 5—*Condition of Patients on Discharge.*

MERIDEN STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	5	3	7	5	20
Improved	47	17	41	16	121
Unimproved	34	18	27	11	90
Died	71	27	47	27	172
Non-tuberculous	0	0	4	1	5
Total	157	65	126	60	408

SHELTON STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	9	5	4	0	18
Improved	72	27	38	28	165
Unimproved	45	25	27	21	118
Died	31	23	21	25	100
Non-tuberculous	2	0	1	3	6
Total	159	80	91	77	407

HARTFORD STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	15	5	23	10	53
Improved	73	26	41	11	151
Unimproved	32	39	57	50	178
Died	84	48	48	29	209
Non-tuberculous	0	5	0	1	6
Total	204	123	169	101	597

TABLE 5—*Condition of Patients on Discharge.—Continued.*

NORWICH STATE TUBERCULOSIS SANATORIUM.

	1916-17		1917-18		
	Male	Female	Male	Female	2 yrs. Total
Apparently arrested	6	7	9	7	29
Improved	26	39	25	32	122
Unimproved	16	18	14	15	63
Died	23	32	38	31	124
Non-tuberculous	1	0	0	1	2
Total	72	96	86	86	340

Patients remaining only a few days classified as "unimproved."

TABLE 6—*Civil Condition of Patients.*

	Male	Female	Total
Married	522	327	849
Single	478	312	790
Widowed	35	37	72
Divorced	7	4	11
Total	1042	680	1722

TABLE 7—*Ages of Patients Admitted.*

	Male	Female	2 yrs. Total
Under 14 years	40	55	95
14 to 20 years	115	130	245
21 to 30 years	341	247	588
31 to 40 years	267	173	440
41 to 50 years	196	47	243
51 to 60 years	66	23	89
Over 60 years	17	5	22
Total	1042	680	1722

TABLE 8—*Nativity of Patient, Father and Mother.*

Total for two years.

	Patient	Father	Mother
Connecticut	626	166	171
United States	269	224	188
Albania	1	1	1
Armenia	1	1	0
Asia Minor	1	1	1
Austria Hungary	134	160	166
Australia	0	0	1
Belgium	1	2	1
Bohemia	1	4	4
Brazil	1	0	0
Canada	25	40	58
Denmark	1	1	1
England	27	53	42
Finland	10	13	13
France	5	12	14
Galicia	2	2	2
Germany	23	73	71
Greece	19	20	20
Ireland	121	332	343

TABLE 8—*Nativity of Patient, Father and Mother.—Continued.*

Total for two years.

	Patient	Father	Mother
Italy	167	227	224
Lithuania	1	2	2
Norway	4	4	5
Nova Scotia	0	0	1
Persia	5	5	4
Poland	34	47	36
Portugal	3	6	5
Roumania	2	2	2
Russia	159	186	188
Scotland	8	19	22
Spain	1	1	1
Sweden	40	56	53
Switzerland	3	4	5
Syria	4	4	4
Turkey	8	8	8
Verdi Islands, Cape	0	0	1
Wales	2	8	12
Western Islands	1	1	1
Unknown	12	37	51
Total native	890	385	359
Total foreign	832	1337	1363
Total	1722	1722	1722

TABLE 9—*Residence of Patients.*

	Total for two years		Total for two years
Ansonia	31	East River	1
Avon	1	Ellington	1
Baltic	3	Elmwood	1
Bantam	1	Enfield	2
Beacon Falls	2	Fairfield	5
Bethel	4	Fair Haven	1
Branford	19	Falls Village	1
Bridgeport	191	Fitchville	1
Bridgewater	1	Forestville	3
Bristol	19	Gales Ferry	1
Brooklyn	2	Glasgow	1
Burnside	3	Glastonbury	6
Canaan	1	Glen Brook	1
Canterbury	1	Goshen	1
Centerville	1	Greenville	2
Central Village	1	Greenwich	3
Cheshire	1	Grosvenordale	1
Chester	2	Groton	2
Clinton	1	Hamden	4
Colebrook	1	Hampton	1
Collinsville	3	Hartford	178
Cornwall	1	Harwinton	1
Danbury	22	Hazardville	2
Danielson	4	Hebron	1
Darien	1	Higganum	1
Deep River	1	Ivoryton	2
Derby	21	Jewett City	9
East Bristol	3	Kensington	1
Eastford	1	Killingly	4
Easthampton	2	Leetes Island	1
East Hartford	2	Lime Rock	1
East Haven	5	Madison	1

TABLE 9—*Residence of Patients.—Continued.*

	Total for two years		Total for two years
Manchester	2	Portland	2
Mechanicsville	1	Putnam	3
Meriden	63	Rockfall	1
Middletown	31	Rockville	7
Milldale	1	Seymour	6
Milford	2	Sharon	1
Montowese	1	Shelton	9
Montville	2	Southbridge	1
Mt. Carmel	1	Southbury	1
Mystic	6	South Coventry	1
Naugatuck	18	Southington	6
New Britain	86	South Manchester	20
New Canaan	3	South Norwalk	7
New Haven	343	Southport	1
Newington	1	South Willington	1
New London	47	Stafford	2
New Milford	3	Stafford Springs	2
Newtown	1	Stamford	80
Northford	2	Stony Creek	1
North Grosvenordale	1	Stonington	6
North Windham	1	Stratford	13
Norwalk	17	Taftville	4
Norwich	60	Thomaston	3
Occum	1	Thompsonville	3
Old Lyme	1	Torrington	17
Orange	1	Trumbull	1
Plainfield	5	Union City	2
Plainville	4	Versailles	2
Plantsville	1	Wallingford	13
Pawcatuck	3	Warehouse Point	2
Pomfret Center	2	Wapping	1
Poquonock	1	Washington	1

TABLE 9—*Residence of Patients.—Continued.*

	Total for two years		Total for two years
Waterbury	136	Willimantic	15
Waterford	5	Windsor Locks	3
Waterville	3	Winsted	3
West Cheshire	1	Woodbridge	1
Westerly	5	Woodbury	1
West Hartford	2	Yantic	2
West Haven	12		
Westport	6	Total	1722
Wethersfield	2		

TABLE 10—*Occupation of Patients.*

	Male	Female	Total
Actor	2	0	2
Agent	2	0	2
Armature winder	0	1	1
Assembler	2	2	4
Auto repairer	2	0	2
Auto trimmer	2	0	2
Baker	3	0	3
Barber	7	0	7
Bartender	14	0	14
Beamer	0	2	2
Bell boy	1	0	1
Blacksmith	5	0	5
Bleacher	2	0	2
Boiler maker	1	0	1
Bookkeeper	1	3	4
Bottlers	1	0	1
Box maker	1	1	2
Brakeman	1	0	1
Brassworker	17	0	17
Bricklayer	2	0	2
Bridgetender	1	0	1
Buffers	12	0	12

TABLE 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Burnisher	3	0	3
Bus boy	2	0	2
Buyer	1	0	1
Cabinet maker	1	0	1
Canvasser	0	1	1
Carpenter	27	0	27
Carpet maker	1	0	1
Cartridge maker	1	0	1
Cashier	0	1	1
Chauffeur	13	0	13
Child's nurse	0	1	1
Cigarmaker	6	0	6
Clerk	40	16	56
Clock maker	2	0	2
Coachman	1	0	1
Companion	0	1	1
Constable	1	0	1
Contractor	1	0	1
Cook	7	3	10
Coremaker	2	0	2
Corset worker	0	2	2
Dipper	1	0	1
Draughtsman	2	0	2
Decorator	1	0	1
Dressmaker	0	5	5
Dye worker	4	0	4
Electrician	12	0	12
Elevator operator	2	0	2
Engine assembler	2	0	2
Engineer	5	0	5
Engraver	1	0	1
Factory foreman	7	0	7
Factory hand	68	60	128
Farmer	10	0	10
Filer	3	0	3
Fireman	11	0	11

TABLE 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Flagman	1	0	1
Floor polisher	1	0	1
Forewoman	0	2	2
Freight clerk	1	0	1
Fruit dealer	1	0	1
Furrier	1	0	1
Gardener	4	0	4
Gear cutter	1	0	1
Glass cutter	2	0	2
Granite cutter	2	0	2
Greenhouse worker	1	0	1
Grinder	3	0	3
Grocery clerk	3	0	3
Gun polisher	1	0	1
Gunsmith	4	0	4
Gun stocker	1	0	1
Hatter	7	0	7
Housewife	0	235	235
Housework	0	147	147
Hostler	2	0	2
Inspector	4	6	10
Insurance agent	1	0	1
Iron moulder	8	0	8
Janitor	4	0	4
Jeweler	1	0	1
Jitney driver	1	0	1
Junk dealer	2	0	2
Knife grinder	2	0	2
Laborer	180	0	180
Lathe hand	5	0	5
Laundry work	1	8	9
Letter carriers	1	0	1
Lithographer	1	0	1
Liveryman	1	0	1
Locksmith	6	0	6
Loom fixer	1	0	1

TABLE 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Lumberman	1	0	1
Machinist	70	0	70
Machine operator	25	2	27
Mail clerk	1	0	1
Mason	7	0	7
Messenger	1	0	1
Metal workers	3	0	3
Mill hand	10	8	18
Millwright	1	0	1
Milliner	0	3	3
Moulders	10	0	10
Motorman	1	0	1
Nurse	0	7	7
Orderly	2	0	2
Packer	2	2	4
Painter	12	0	12
Paper hanger	1	0	1
Peddler	3	0	3
Photographer	2	0	2
Pin boy	1	0	1
Piano maker	1	0	1
Piano tuner	1	0	1
Platers	5	0	5
Plumbers	9	0	9
Polisher	17	1	18
Porter	3	0	3
Postmaster	2	0	2
Press feeder	4	2	6
Printer	5	2	7
Pupils	35	50	85
Range setter	1	0	1
Reporter	1	0	1
Rubber worker	11	1	12
Sailor	2	0	2
Salesman	11	0	11
Saleswoman	0	5	5
Section foreman	1	0	1

TABLE 10—*Occupation of Patients.—Continued.*

	Male	Female	Total
Shipping clerk	1	0	1
Shoemaker	4	0	4
Shop hand	34	18	52
Slater	1	0	1
Soldier	2	0	2
Stage hand	1	0	1
Stationman	1	0	1
Steamboat pilot	1	0	1
Steamfitter	3	0	3
Stenographer	3	9	12
Steward	1	0	1
Stoker	1	0	1
Stone cutter	5	0	5
Stone mason	3	0	3
Students	9	14	23
Tailor	9	1	10
Teacher	1	8	9
Teamsters	38	0	38
Telegraph operator	1	0	1
Telephone	0	5	5
Telephone worker	2	0	2
Timekeeper	2	0	2
Tinsmith	2	0	2
Tobacco stripper	0	1	1
Tool maker	7	0	7
Trainman	1	0	1
Trolley conductor	1	0	1
Truckman	2	0	2
Waiter	11	6	17
Watchmaker	4	0	4
Watchman	3	0	3
Weaver	24	9	33
Wire worker	3	0	3
Wood worker	5	0	5
Writer	0	1	1
No occupation	21	28	49
Total	1042	680	1722

Report of the Secretary.

BEGINNING OCTOBER 1, 1916, AND ENDING SEPTEMBER 30, 1917

MAINTENANCE.

Receipts.

Cash on hand October 1, 1916		$930 87	
Maintenance appropriation	$213,252 10		
Board of patients at Hartford Sanatorium	36,893 92		
Board of patients at Meriden Sanatorium	29,580 35		
Board of patients at Norwich Sanatorium	18,556 68		
Board of patients at Shelton Sanatorium	25,072 66		
Misc. receipts, Hartford Sanatorium	203 07		
Misc. receipts, Meriden Sanatorium	690 05		
Misc. receipts, Norwich Sanatorium	327 76		
Misc. receipts, Shelton Sanatorium	144 76		
Cancelled check	93 02		
		$324,814 37	
Total			$325,745 24

Disbursements.

Maintenance of Hartford Sanatorium	$103,309 12		
Maintenance of Meriden Sanatorium	81,354 06		
Maintenance of Norwich Sanatorium	64,758 70		
Maintenance of Shelton Sanatorium	76,120 42		
Commission office expense	201 17		
		$325,743 47	
Balance, cash on hand, Sept. 30, 1917	$1 36		
Balance, maintenance appropriation	41		
		1 77	
Total			$325,745 24

STATEMENT OF INSURANCE ON FIRE LOSS AT SHELTON SANATORIUM.

Cash balance, October 1, 1916	$2,783 94
Expended on construction of new cottage	2,783 94

EQUIPMENT.

Appropriation	$6,350 40

DISBURSEMENTS.

Equipment of Hartford Sanatorium	$1,037 20		
Equipment of Meriden Sanatorium	150 00		
Equipment of Norwich Sanatorium	8 00		
Equipment of Shelton Sanatorium	1,340 40		
Construction of Superintendent's cottage, Shelton Sanatorium	1,687 66		
		$4,223 26	
Balance on hand, Sept. 30, 1917		2,127 14	
Total			$6,350 40

SALARIES AND EXPENSES OF COMMISSIONERS AND SECRETARY.

Receipts.

Commissioners' salary appropriation	$7,500 00	
Commissioners' expense appropriation	1,800 00	
Secretary's salary appropriation	1,583 32	
Total		$10,883 32

Disbursements.

Dr. Stephen J. Maher, salary	$2,500 00	
Dr. Stephen J. Maher, expenses	400 00	
Dr. David R. Lyman, salary	2,500 00	
Dr. David R. Lyman, expenses	400 00	
Jonathan Godfrey, salary	624 99	
Jonathan Godfrey, expenses	100 00	
Wallace S. Allis, salary	1,875 01	
Wallace S. Allis, expense	300 00	
George I. Allen, Secretary, salary	1,583 32	
	$10,283 32	
Commissioners' expense appropriation balance (reverted to State treasury)	600 00	
Total		$10,883 32

BEGINNING OCTOBER 1, 1917, AND ENDING SEPTEMBER 30, 1918.

MAINTENANCE.

Receipts.

Cash on hand October 1, 1917	$1 36	
Maintenance appropriation	$480,000 00	
Board of patients, Hartford Sanatorium	34,180 94	
Board of patients, Meriden Sanatorium	24,344 48	
Board of patients, Norwich Sanatorium	18,618 22	
Board of patients, Shelton Sanatorium	15,972 05	
Misc. receipts, Hartford Sanatorium	1,138 98	
Misc. receipts, Meriden Sanatorium	489 95	
Misc. receipts, Norwich Sanatorium	182 98	
Misc. receipts, Shelton Sanatorium	203 99	
	$575,131 59	
Total		$575,132 95

Disbursements.

Maintenance of Hartford Sanatorium	$104,867 91	
Maintenance of Meriden Sanatorium	86,835 73	
Maintenance of Norwich Sanatorium	74,894 91	
Maintenance of Shelton Sanatorium	74,231 99	
	$340,830 54	

Balance, cash on hand Sept. 30, 1918 ...	$ 5,513 14		
Cash advanced on office account	30 65		
Balance, maintenance appropriation	228,758 62		
		$234,302 41	
Total			$575,132 95

STATEMENT OF INSURANCE ON FIRE LOSS AT NORWICH SANATORIUM.

Insurance on barn, Norwich (destroyed by fire Dec. 10, 1918) ..		$3,603 12
Disbursements.		
To construction of new barn	$3,280 34	
Balance, cash on hand Sept. 30, 1918	323 78	
Total		$3,603 12

CHILDREN'S SEASIDE SANATORIUM.

Appropriation		$25,000 00
Disbursements.		
Total expended to Sept. 30, 1918	$12,621 53	
Balance, cash on hand Sept. 30, 1918	12,378 47	
Total		$25,000 00

CONSTRUCTION.

	Appropriation.	Expended to Sept. 30,'18.	Balance.
Coal bins	$ 1,000 00		$ 1,000 00
Glass sash	8,000 00	$ 7,984 66	15 34
Hartford poultry plant	2,000 00	1,537 40	462 60
Hartford sewage plant	5,000 00	719 24	4,280 76
Incinerator	3,000 00	1,727 00	1,273 00
Laundry	30,000 00		30,000 00
Norwich infirmary	22,000 00	19,226 40	2,773 60
Norwich isolation rooms	8,000 00	6,799 13	1,200 87
Norwich Superintendent's cottage	7,500 00	5,382 95	2,117 05
Recreation halls	10,000 00	2,500 00	7,500 00
Root cellar	2,000 00	1,715 19	284 81
Shack alteration	9,000 00	8,040 16	959 84
Shelton's helps' dining-room	700 00	700 00	
Shelton infirmary	55,000 00	53,665 79	1,334 21
Shelton nurses' home	3,000 00	3,000 00	
Shelton wagon shed and stable	1,500 00	533 02	966 98
Shelton water supply	2,500 00	737 00	1,763 00
Sleeping porch	3,000 00		3,000 00
Storeroom facilities	2,500 00	1,067 20	1,432 80
Total construction appropriation			$175,700 00

Disbursements.		
Total expended on construction appropriation	$115,335 14	
Balance, cash on hand	60,364 86	
Total		$175,700 00

PUBLICATION
APPROVED BY
THE BOARD OF CONTROL

THE MANSFIELD STATE TRAINING SCHOOL AND HOSPITAL

TRUSTEES.

JUDGE L. P. WALDO MARVIN, *President*

JOHN M. LEE, *Secretary*

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DR. JOHN C. GODDARD

LOUISE H. MERRITT

DR. GEORGE BLUMER.

Superintendent

DR. CHARLES T. LAMOURE

TO HIS EXCELLENCY, MARCUS H. HOLCOMB,
GOVERNOR OF CONNECTICUT.

Sir:—

We have the honor to present the following report of the Mansfield State Training School and Hospital for the two years ending September 30th, 1918:—

Consideration of the desirability of merging the Conn. Training School for the feeble-minded and the Conn. Colony for Epileptics and of how the merger could be best brought about consumed much of the time the Committee on Humane Institutions of the last General Assembly was able to give to these wards of the State, but a workable law was finally enacted and received your approval and an appropriation of $250000. was made for new buildings, real estate, etc., for the new institution, in addition to the usual appropriation for maintenance.

This law provided in substance, not only that buildings should be erected at Mansfield, adequate to house all the feeble-minded at Lakeville, but that, on July 1st, 1917, the control of the two institutions should pass into the hands of a new board of seven trustees to be known as the Trustees of the Mansfield State Training School and Hospital. Having been appointed such trustees by you, the subscribers entered upon the performance of their duties and took possession and control of the property and inmates of both institutions July 1st, 1917.

The conditions to be encountered were well known to most of us, who had been trustees of the Conn. School for the Feeble-minded or of the Conn. Colony of Epileptics, and are well described in the reports of both boards made to you prior to January, 1917. There were about 300 feeble-minded persons in the old School for Imbeciles at Lakeville which the State had practically decided to abandon. At Mansfield, on property owned by the State and theretofore occupied by the Colony for Epileptics, there were two ward buildings, holding

100 epileptics, a kitchen, a combined power house and laundry, and three farm houses occupied by employees. Separated from these, to some extent, by the contour of the land, there were in process of construction ward buildings for 250 or more feeble-minded, a kitchen, a laundry, and a building for employees, all connected with the power house above mentioned which was to be enlarged to meet the new demands thus made upon it The completion of this work required the expenditure of all appropriations available prior to October 1st, 1917, i. e., $200,000. appropriated to the Conn. School for the Feebleminded by the General Assembly of 1915, $2500. appropriated to the Colony for Epileptics, and the proceeds of the sale of the property at Lakeville. It, therefore, became our duty to carry on and complete this work and to further expend $250,000. in such a way as to effect the combination of the two institutions and increase their capacity as speedily and economically as circumstances would permit.

Our first decision was to abandon the attempt to separate feeble-minded from epileptic cases, except so far as wards and buildings permitted, and to make use of the contour of the land, for the separation of the sexes. Contracts were accordingly let for the erection on the hill occupied by epileptics of an additional ward building and a congregate dining hall. When completed all the buildings on this hill will accommodate about 300 females. Changes have also been made in the buildings for feeble-minded commenced prior to January 1st, 1917, so that these will accommodate 300 males. In addition, we have purchased and adapted for occupancy a house and garage for the Superintendent, a house for the steward, a house for the chief cook, and a house for female employees such as teachers, etc. The farm house heretofore occupied by the Superintendent has been renovated and made into an administration building; the water supply has been increased 10,000 to 12,000 gallons a day; a store house erected on the spur track of the railroad; all boilers, engines and pumps duplicated to minimize the danger of a break down; and the whole community, houses and roads, lighted by our own electricity. Thus $250,000. has been spent and the work substantially completed so that the State today has accommodation for at least 600

inmates at Mansfield, 300 males and 300 females, each sex occupying a group of buildings by itself consisting of dormitories, kitchen and dining room, but each group served by the same power house and laundry. The property of the State at Lakeville has been sold for $25,000., and the inmates and furniture moved to Mansfield. The consolidation has been effected and had the war continued it would have been possible for the State to continue to care for the epileptics and feeble-minded already in its charge at the institution at Mansfield as it now stands.

This, however, by no means disposes of Connecticut's problem and duty with relation to the epileptic and feeble-minded. The use of the term feeble-minded has its drawbacks as well as its advantages. It is broad enough to cover idiots and imbeciles and sounds better. In fact people are not partial to having their children branded as being feeble-minded and for this reason the institutions for the epileptic and feeble-minded, when they united, dropped both epithets and adopted a title more non-committal. Nevertheless the term feeble-minded, though broad, is not necessarily vague. It is trite to say that other people's children are feeble-minded; many people do it, and perhaps it was some all-embracing and indefinite meaning of the word that was in the mind of our Supreme Court some years ago when it hesitated to pronounce valid that part of the Connecticut Statute forbidding the marriage of feeble-minded persons. Since then medical science has given a precise meaning to the term and has devised means for accurately determining the degree of mental defect. As well might a person of intelligence today profess skepticism as to the diagnosis, prevalence and transmissability of tuberculosis as of feeble-mindedness. It is not mere dullness, stupidity, or laziness, to be overcome by training, but a mental defect, scientifically recognizable, always incurable, and exceedingly liable to be handed down from generation to generation

An authority on feeble-mindedness recently quoted in a legal magazine of repute says:—

"Every feeble-minded person is a potential criminal. This is necessarily true since the feeble-minded lacks one or the other of the factors essential to a moral life—an appreciation of right and wrong, and the power of self-control. If he does not know right and wrong, then of course he is as likely ot do the wrong thing as the right. Even if he has the sufficient intelligence and has had the necessary training so that he does know, since he lacks the power of self-control he is unable to resist his natural impulses. Whether the feeble-minded person becomes a criminal thus depends on his temperament and his environment. If he is of a quiet phlegmatic temperament he may never be impelled to do anything seriously wrong. In this case, when he cannot earn a living he will starve to death unless philanthropic people provide for him. On the other hand, if he is a nervous, excitable, impulsive person he is almost sure to turn in the direction of criminality. But whatever his temperament, in a bad environment, he may still become a criminal, the phlegmatic temperament becoming simply the dupe for more intelligent criminals, while the excitable, nervous, impulsive feeble-minded person may escape criminality if his necessities are provided for and his impulses and energies turned in a wholesome direction." His estimate is that 50% of all criminals are feeble-minded.

In Connecticut we have at Mansfield 400 or more whose average age mentally will never be above that of children 6 to 8 years old. We have a waiting list of more than 200 known to be feeble-minded, aside from 200 cases now in almshouses and about 250 in institutions for the insane definitely known to be feeble-minded. Experts place the whole number in Connecticut at between 2000 and 3000.

The same may be said of the epileptic. It does not require a field glass and a book of logarithms to locate it, or even the refinements of an expert in insanity. The laws of most states forbid the marriage of epileptics because of the transmissability of the disease. These laws are honored more by their infraction than by their enforcement. No reliable estimate of the epileptics at large in Connecticut can be made. Like feeble-mindedness it is practically incurable. A very

GIRLS' DEPARTMENT

large percentage of the feeble-minded are likewise epileptic. All epileptics deteriorate mentally to a greater or less degree. Many of them become insane.

It is not our aim to attempt to provide for any such population at present—the task is too immense. It is not possible to effect cures, we do not expect it. We *do* expect to keep them from becoming criminals and from transmitting their defects to children more numerous than they, in either case multiplying the drain on the resources of the State. Furthermore we *do* expect to turn their energies and activities into wholesome directions and, without enslaving or overtasking them, to give them enough to do to enable them to keep happy and possibly contribute something to their own support.

At Mansfield we have more than 600 acres of land, some tillable, some pasturage, some woodland. We have nearly a hundred head of cattle, 300 or 400 chickens, 40 or 50 pigs. We raise all our own corn, potatoes, vegetables, some of our fruit, eggs, milk and butter. The labor of both males and females goes into this. In addition, the boys do grading, mattress, brush and rug making, shoe repairing, etc., and the girls help in the laundry, mend clothes and make baskets, embroidery, etc.

We need

(1). A more adequate water supply;
(2). A congregate dining hall for males;
(3). A combination, assembly hall, gymnasium and school, with some rooms for employees;
(4). One or more dormitories;
(5). Roads and walks connecting the buildings and usable at all seasons of the year;
(6). Additions and repairs to the sewer beds and existing buildings.

Immediately after we moved from Lakeville and before we were half settled in our new quarters, the institution was visited by the prevalent epidemic of influenza. Out of nearly 200 cases of this and analagous diseases we lost less than 30. At one time there was no physician available other than our Superintendent and in one building there was but, one nurse.

being erected near the buildings erected by the Connecticut Colony for Epileptics. The two ward buildings, the employees building, kitchen, and laundry are all enclosed but there is much to be done before they will be ready for occupancy.

Our per capita cost is high on account of conducting two incomplete institutions of small size; also because there is such a demand for admission that the most urgent cases are given preference and most of the urgent cases are of low mentality, many cases crippled and deformed, and of a type requiring constant care and will require constant care during their life Until the capacity of the School is increased to accommodate all the feeble-minded and epileptics needing care and we receive able bodied cases of a higher grade who will be able to assist with the work of the institution, our expenses will continue to be high.

Respectfully submitted,

CHAS. T. LAMOURE.
Superintendent.

BOYS' DEPARTMENT

CONN. TRAINING SCHOOL FOR FEEBLE MINDED. LAKEVILLE, CONN.

Period Beginning Oct. 1, 1916 *and Ending June* 30, 1917.

POPULATION REPORT.

	Male	Female	Total
Patients present at beginning of period	151	144	295
Admitted, and parole returns for period	21	18	39
	9	4	13
Discharge, died, and paroled	13	18	31
	8	4	12
Present at end of period	160	144	304
Daily average attendance			298
Total number weeks attendance			11622
Average number employees and officers	22	38	60

CONN. COLONY FOR EPILEPTICS.

From Oct. 1, 1916 *to June* 30, 1917.

POPULATION REPORT.

	Male	Female	Total
Present at beginning of period	48	50	98
Admitted during period	6	8	14
Died and discharged during period ..	6	8	14
Present at end of period	48	50	98
Daily average attendance			97
Total attendance			3783
Average number officers and employees .	24	11	35

EXPENSES.

CONN. TRAINING SCHOOL FOR FEEBLE MINDED. LAKEVILLE, CONN.

From Oct. 1, 1916 *to June* 30, 1917.

Salaries and wages	$21,248.67
Clothing	4,712.09
Subsistence	19,296.01
Furniture and bedding	2,311.56
Ordinary repairs	1,852.73
Office, domestic and outdoor	18,333.04
Total gross expenses	67,754.10
Less sales	260.65
Total net current expenses	67,493.45

CONN. COLONY FOR EPILEPTICS.

From Oct. 1, 1916 *to June* 30, 1917.

Salaries and wages	$15,052.40
Clothing	519.10
Subsistence	5,940.45
Furniture and bedding	858.14
Ordinary repairs	530.11
Office, domestic and outdoor	9,814.42
Total gross expenses	32,714.62
Less sales	2,243.64
Total net current expenses	30,470.98

CONN. TRAINING SCHOOL FOR FEEBLE MINDED. LAKEVILLE, CONN.

From Oct. 1, 1916 *to June* 30, 1917.

PER CAPITA COST.

Total attendance	11,622
Total net current expenses	$67,493.45
Average net cost, per patient, per week	5.80

CONN. COLONY FOR EPILEPTICS.

From Oct. 1, 1916 *to June* 30, 1917.

PER CAPITA COST.

Total attendance	3783
Total net current expenses	$30,470.98
Average net cost, per patient, per week	8.05

COMBINED REPORT OF CONN. COLONY FOR EPILEPTICS AND CONN. TRAINING SCHOOL FOR FEEBLE MINDED.

From Oct. 1, 1916 *to June* 30, 1917.

POPULATION REPORT.

	Male	Female	Total
Present at beginning of period	199	194	393
Admitted and parole returns	36	30	66
Died, discharged and paroled	27	30	57
Present at end of period	208	194	402
Daily average attendance			395
Total attendance, in weeks			15,405
Average number officers and employees	46	49	95

EXPENSE REPORT.

Salaries and wages	$36,301.07
Clothing	5,231.19
Subsistence	25,236.46
Furniture and bedding	3,169.70
Ordinary repairs	2,382.84
Office, domestic and outdoor	28,147.46
Total gross expenses	100,468.72
Less sales	2,504.29
Total net current expenses	97,964.43

PER CAPITA COST.

Total attendance, weeks	154.05
Total net current expenses	97,964.43
Average net cost, per patient, per week	6.36

MANSFIELD STATE TRAINING SCHOOL AND HOSPITAL. MANSFIELD DEPARTMENT.

From July 1, 1917 *to September* 30, 1917.

POPULATION REPORT.

	Male	Female	Total
Present at beginning of period	48	50	98
Admitted during period	31	1	32
Died and discharged during period	2	1	3
Present at end of period	77	50	127
Daily average attendance			109
Total attendance			1414
Average number officers and employees	24	11	35

LAKEVILLE DEPARTMENT.

POPULATION REPORT.

From July 1, 1917, *to September* 30, 1917.

	Male	Female	Total
Patients present at beginning of period	160	144	304
Admitted and parole returns for period	14	12	26
Discharged, died and paroled	24	4	28
Present at end of period	150	152	302
Daily average attendance			299
Total number weeks attendance			3993
Average number officers and employees	22	38	60

MANSFIELD STATE TRAINING SCHOOL AND HOSPITAL.

From July 1, 1917 *to September* 30, 1917.

EXPENSE REPORT.

Salaries and wages	$12,099.83
Clothing	1,742.50
Subsistence	8,412.11
Ordinary repairs	1,136.04
Furniture and bedding	794.60
Office, domestic and outdoor	9,248.22
Total gross expenses	33,433.30
Less sales	837.00
Total net current expenses	32,596.30

PER CAPITA COST.

Total attendance, weeks	5,407
Net current expenses	$32,596.30
Average net cost, per patient, per week	6.029

TO THE TRUSTEES:

For the year ending September 30, 1918 I respectfully report the general good health of our population, and the completion of several buildings. I would also outline some of the more pressing needs of the school.

While good health has prevailed generally during the year, the influenza made its appearance the latter part of September and at the close of the fiscal year we had seventy cases.

During the year 131 cases were admitted and 118 have been discharged, transferred, or died, the average daily attendance being 413. A great proportion of the children admitted are of the lowest type mentally and many are crippled and deformed. Such cases require much care and during their lives will never be able to take part in the activities of the school.

The children cared for at the Lakeville branch of the school were transferred to Mansfield in September, 1918.

Hillsside Hall, a wooden structure purchased in October 1917 and which housed twenty boys from Lakeville was destroyed by fire at 3 A. M. January 3d, 1918. Fortunately, no one was injured.

The new laundry building was opened in November 1917. Early in 1918 the power house was completed and two new boilers and a second dynamo were installed.

The Reynolds house which was purchased in October 1917 has been repaired and is now used as a residence for the Superintendent.

The brick dwelling formerly used as a residence by the Superintendent of the Colony for Epileptics is now used as an office building. A thirty station telephone switchboard has been installed replacing the party line formerly used.

A congregate dining room has been erected connecting with the kitchen of the former Colony for Epileptics, and when completed the space in the basements of the ward buildings now used for dining rooms will be available for day rooms.

The new kitchen building, employees' building, dormitory and custodial building are completed and occupied. Upon the completion of the custodial building for girls now being erected near the buildings of the former Colony for Epileptics we will be able to care for all our girls on one side of the natural ravine extending through the property—the boys on the other

At present we are using the basement of the boys custodial building for dining rooms. I would recommend the erection of a congregate dining room for the boys' group connecting with kitchen No. 2. The basement of the custodial building can then be used as industrial rooms and play rooms.

An additional dormitory building for boys is needed to enable us to care for those now seeking admission.

An employees' home is needed. We are even now finding it difficult to provide suitable quarters for our employees, and this difficulty will, of course, increase with the natural growth of the school.

A school building with a gymnasium is very much needed. The gymnasium would also provide a place for dances and entertainments for both patients and employees.

There is much grading to be done about the different buildings. Walks and roads must also be built.

During the past year a supplemental water supply has been obtained but if our school is increase to any extent a still greater supply of water must be provided.

We have applications for the admission of 200 cases. As this is the only state institution in Connecticut caring for the epileptic and the feeble minded it would seem of the greatest importance, for the good of the individual and the protection of society, that suitable provision be made for the care and training of these classes of unfortunates.

Respectfully submitted,

CHARLES T. LAMOURE,

Superintendent.

State of Connecticut

STATISTICAL FORM FOR ALL STATE INSTITUTIONS.

Name of Institution—Mansfield State Training School & Hospital.

Population for year ended September 30th, 1918.

	Male	Female	Total
Number of inmates at beginning of fiscal year	210	202	412
Number received during the year	85	46	131
Number discharged or died during the year	71	47	118
Number at end of fiscal year	224	201	425
Daily average attendance for year			413.6
Total number of weeks attendance for year			21,566.2
Average number of officers and employees for year	67	53	120

Expenditures for year ended September 30th, 1918.

CURRENT EXPENSES.

Salaries and wages	$ 52,146.32	
Clothing	9,563.85	
Subsistence	42,830.41	
Furniture and bedding	6,807.99	
Ordinary repairs	2,396.79	
Board of inmates at other institutions ——weeks at $——per week	0.00	
Office, domestic and outdoor expenses	60,920.58	
Total, gross current expenses	174,665.93	
Less earnings and sales	3,443.76	
Total, net current expenses		$171,222.17

EXTRAORDINARY EXPENSES.

New buildings, land, etc.	263,810.79	
Permanent improvements to existing buildings	0.00	
Total, extraordinary expense		263,810.79
Grand total of all expenses		$438,476.72

AVERAGE NET COST.

Total attendance above, weeks	21,566.2
Total net current expenses above	$171,222.17
Average net cost, per inmate, per week	7.94

State of Connecticut

PUBLIC DOCUMENT No. 67

FIRST ANNUAL REPORT

OF THE

Board of Directors

OF THE

Connecticut State Farm For Women

TO

THE GOVERNOR

For the Period Between July 1, 1917, and September 30, 1918

PRINTED IN COMPLIANCE WITH STATUTE

HARTFORD
PUBLISHED BY THE STATE
1918

45

PUBLICATION
APPROVED BY
THE BOARD OF CONTROL

REFORMATORY PRESS
CHESHIRE, CONN.

BOARD OF DIRECTORS

	Term Expires
WILLIAM B. BAILEY, New Haven,	July 1, 1925
VALERIA H. PARKER, Hartford,	July 1, 1919
JOHN H. GOSS, Waterbury,	July 1, 1920
ANNE ROGERS MINOR, Waterford,	July 1, 1921
EDWARD W. HAZEN, Haddam,	July 1, 1922
GEORGE C. CLARK, Plymouth,	July 1, 1923
HELEN W. ROGERS, Hamden,	July 1, 1924

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26 Edgewood Avenue, New Haven

VALERIA H. PARKER, *Secretary,*
42 High Street, Hartford

GEORGE C. CLARK, *Treasurer,*
Terryville, Conn.

REPORT OF THE BOARD OF DIRECTORS
OF THE
CONNECTICUT STATE FARM FOR WOMEN.

To his Excellency, Marcus H. Holcomb, Governor:

Sir: The Board of Directors of the Connecticut State Farm for Women, appointed by you on July 1, 1917, in compliance with the provisions of the law* passed by the General Assembly of 1917 establishing this institution, has the honor to present its first annual report covering the period between its appointment and the fiscal year ending September 30, 1918.

SELECTION OF THE SITE.

The first task confronting your board after its organization on August 3, 1917, was the selection of a suitable site. As two sets of requirements had to be taken into consideration, the physical and the administrative, this task was one neither quickly nor easily accomplished. As a result, although a special committee began its search during the summer of 1917, it was not until the following spring that the property finally chosen by the board passed into the possession of the State.

According to the law certain definite physical conditions were required:

1. That not less than two hundred acres should be purchased;
2. That such land should include woodland;
3. That such land should include tillable pasture;
4. That there should be a natural water supply and
5. That it should be located reasonably near a railroad.

It was also necessary to keep constantly in mind cer-

*The text of this act is given in full on pages 27-31.

tain other conditions which were either defined or implied in the statute:

1. The kind of inmate to be provided for;
2. The probable ultimate number to be housed;
3. The nature of their activities and
4. The type of institution required—congregate or cottage plan.

The law which established this institution for the correction of delinquent women, placed no limit with reference to the maximum age nor to the offences for which they might be committed—thus implying that all sorts and conditions must be accepted and provided for. According to statistics compiled by the Connecticut Prison Association in 1916, approximately eight hundred such women appear annually on the record books of our ten county jails, to which number doubtless more will be added as the result of the nation-wide campaign to control the spread of venereal disease. A large proportion of these will be rated as reformable cases and as such will be committed by the judges of our courts to the Connecticut State Farm for Women. In giving to the new institution this name and by specifying two hundred acres as a minimum the framers of the law implied that the vocational and recreational activities to be provided for must be largely of an out-door nature. Again, the law definitely required that the institution must be built on the cottage plan and that there must be a careful segregation of groups. All of these conditions, when considered together, called for a site of such extent, topography and location, as would secure an adequate separation of groups and sufficient privacy in open air work and play for a population of from five to ten hundred women. In a word, the site for the Connecticut State Farm for Women had to provide for a self-supporting institution on the colony plan.

Theoretically, and in strict justice to their respective treasuries, this colony ought to be centrally located in relation to the cities from which its inmates are likely to be committed. Such a center, taking as representative

the number of inmates in the jails of the four largest counties during the preceding year, was found to lie in New Haven County between Mt. Carmel and Cheshire. Although the soil and water supply were excellent in this district the land was too much divided into small tracts and too expensive to admit of serious consideration.

At the outset the committee hoped that the site might be donated or that the state might already own suitable property, thus leaving our small appropriation of fifty thousand dollars intact for the development of the institution. After inspecting a number of sites the choice narrowed to three and finally hovered above one owned and offered by the Connecticut Agricultural College and which had the very obvious advantage of several excellent buildings and barns ready for immediate occupancy. Before making a final choice, however, your board decided to call into consultation two groups of experts, one qualified to pass upon the physical conditions required by law and one experienced in the actual administration of institutions for delinquent women. As most competent for the first task, the board invited your Commission to Investigate the Advisability and Cost of Erecting New Buildings for the State Prison to help us determine wisely. Although this commission had no authority to act in an official capacity, two of its members inspected the property. One of them, Mr. Herbert E. Gregory, Professor of Geology at Yale, made a careful study not only of this site and those recommended by the Norwich Chamber of Commerce but of the one ultimately purchased. At the same time, Mrs. Jessie D. Hodder, Superintendent of the Massachusetts Reformatory for Women, Dr. Katharine Bement Davis, formerly head of the New York State Reformatory for Women at Bedford, and Mrs. Martha P. Falconer, Director of the Section on Reformatories and Detention Homes for Women, Law Enforcement Division of the War Department, were asked to inspect the properties from the point of view of their experiences as administrators of correctional institutions for women and girls. Mrs. Falconer was unable to come on at the time but later

approved the site finally selected. Dr. Davis saw the Newington property but Mrs. Hodder carefully inspected not only the one principally under consideration but all of the three best sites presenting a scholarly report with recommendations. Acting on the advice of these disinterested experts, your board regretfully declined the property offered by the Connecticut Agricultural College as unsuited for the purpose intended and again began its search. On April 1, 1918, after having visited twenty-one different properties, we unanimously voted to purchase Bride Lake Farm, already pronounced by Mrs. Hodder the best and most beautiful site for a reformatory she had ever seen and later approved by Professor Gregory as meeting the conditions of the law in every particular.

THE SITE.

Bride Lake Farm is situated in New London County on the Lyme Highway, one mile from Long Island Sound and the Shore Line Division of the New York, New Haven and Hartford Railroad, three miles from the station of East Lyme and Niantic and nine miles from New London. The tract purchased embraces seven hundred and fifty acres and entirely surrounds Bride Lake, a beautiful body of water covering seventy-three acres, famous even back to Indian times for its trout fishing and approached by a part of the Mohegan trail. This lake and a smaller one with the connecting stream will furnish an inexhaustible water supply. The land slopes gradually to the lake in a vast amphitheatre offering ample opportunity for the erection of buildings with unobstructed views. The entire property was composed of four farms with a few smaller tracts required to round out the section. At the time of purchase there were upon the property four farm houses with barns, sheds and out-buildings. Two of the barns are large and one of them was constructed for scientific dairying. There are about two hundred acres of tillable land which is somewhat run down but which will respond to proper treatment. In addition there is ample pasture and woodland, the latter being sufficient to fur-

nish not only fuel for the institution but considerable revenue besides. These farms were purchased at a final cost of twenty-eight thousand and one hundred dollars, thus approximating a little more than thirty-eight dollars an acre, a price below that paid for sites for similar purposes in other states. Iowa paid $50,000 for 218 acres; Maine, $8,000 for 200; Massachusetts, $36,853 for 329; New York, $93 an acre for 107 purchased in 1892 for the Reformatory for Women at Bedford Hills and in 1911 $455 an acre for 88 additional. New York also expended $125 each for 92 acres for the Western House of Refuge and Pennsylvania paid $60 an acre for 500 recently purchased.

With the limited amount remaining after the purchase of the land, the building of new cottages or the cultivation of the farm on a large scale and the maintenanee and supervision of a large group of inmates was obviously out of the question. The alternatives were, either to postpone the opening of the institution until larger appropriations were voted or to make as sanitary and comfortable as possible at the minimum expense the houses already on the land and to accept as large a number of women as these would accommodate and our funds maintain. This latter alternative was chosen not only because it was in keeping with the intent of the law but as the one best ministering to the needs of the state and the most helpful in defining the future needs of the institution.

DEVELOPMENT OF THE INSTITUTION.

The site selected, it would have been in logical sequence to have elected at once a general superintendent experienced in the institutional management of delinquent women. This your board earnestly endeavored to do, beginning its search even before the site was actually purchased. Of the belief that the position ought to attract to it a woman of national reputation in penology, on February 6, 1918, the superintendency of the Connecticut State Farm for Women was offered to Mrs. Jessie D. Hodder of the Massachusetts Reformatory for Women. Af-

ter giving the matter serious consideration, Mrs. Hodder decided that she ought not to leave her institution at a critical time in its history. She was, however, sufficiently interested in our problem to be willing to be called into consultation until a permanent superintendent could be found. Accordingly, on April 1, 1918, with the approval of the Massachusetts Board of Prison Commissioners, who generously gave the state of Connecticut her services without salary, Mrs. Hodder was appointed our advisory superintendent. To her wise counselling the Connecticut State Farm for Women owes a lasting debt of gratitude for its subsequent development.

The site selected, an advisory superintendent to guide, the next step was the cultivation of the land for the support of the coming inmates. As the board had turned to the best experts obtainable to assist in the selection of its site, so now it asked the cooperation of various of your state departments—the Connecticut Agricultural College, the State Forester, the Fish and Game Commissioner and the State Board of Health. Through the courtesy of Professor E. H. Jenkins of the Experiment Station, Mr. William L. Slate, Jr., Professor of Agronomy at the Agricultural College, tested the soil and planned the spring planting. An acting farm superintendent was employed who began on May first to carry out these plans and has ever since proved invaluable in his faithful and untiring service. Mr. H. L. Garrigus, Professor of Animal Husbandry at the same institution and also representing a committe of the State Council of Defence, met with the board and after looking over the land recommended the purchase of a carload of steers for the two-fold purpose of cooperating with the Council in its efforts to increase the food supply of the state and also of adding to the fertility of the worn out soil. This recommendation was carried out, Professor Garrigus himself selecting the steers in the Chicago stock yards. The Professor of Poultry Husbandry, Mr. W. F. Kirkpatrick, inspected the outbuildings and made suggestions for the future development of this department. Mr. S. P. Hollister, Instructor

in Horticulture, planned the spraying of the orchards which has since been carried out according to his directions. Mr. Walter O. Filley, the State Forester, made several visits to the woodland which was finally purchased on his recommendation and will be cut in rotation as planned by him. The waters of Bride Lake, we found, had already been stocked with California Salmon and declared a state preserve. The written reports of these visiting experts were placed in the hands of one of the members of the board of directors who has endeavored to carry out their suggestions as rapidly as war time conditions and the funds at our disposal would permit.

At the same time the representatives of the State Board of Health made a careful examination of the sanitation and the water supply at all of the houses and farms. The original plumbing was put in order for temporary use but later all contracts were let on the basis of plans and recommendations of the Health Commissioner. These changes, now well under way, include running water, hot and cold, in each house and emergency hospital, inside toilets, septic tanks for the disposal of waste, and furnace heat. All the houses have wire screens, full length, and screwed on from the outside. Telephone connections have been made in all of the three houses but so far, efforts to have electricity installed have been unsuccessful.

From the first it had been the plan of the board to have the inmates do the largest possible share of the work of the institution out doors as well as the renovation of the buildings. It was hoped that it would be found practicable and possible, under the law of 1915, permitting prisoners to be employed outside of the prison walls if within the state and accompanied by the proper official, to transfer with their matron the inmates of the women's department at the State Prison for the purpose of putting the cottages in readiness, first for themselves and then for future groups to be sent from the courts. The directors, however, decided that the responsibility for this group at so great a distance from the prison was too much to be assumed. They evidenced their willingness to cooperate,

however, by granting a four month's leave of absence to their matron to assist in starting the institution. On June 17, 1918, she and her assistant, a practical nurse, went on duty in the first farm house on the Lyme Highway, a few supplies and furnishings having been previously ordered. By July first, as a result of their hard pioneer work and just one year from the date of our appointment, your board was able to report that we were ready to receive a limited number of inmates. On July 10, 1918, the Connecticut State Farm for Women was declared officially open by your proclamation and on July 13, the first inmate was committed to us from the city court of New Britain. During the latter half of this month twelve women were admitted filling the first house to its capacity. During this time, under the direction of the matrons these women had not only cleaned and settled their own house but had made habitable the second farm house so that by August first we were able to transfer the younger girls to the latter under two additional attendants and to accept fifteen more inmates during this month. By September first our limit had been reached but because of the transfer of one inmate to the Norwich State Hospital for the Insane, of another to the Norwich Jail for temporary care, and one escape, we were enabled to receive two more women bringing the total admissions up to 29. Of these 26 were in residence on September thirtieth.

VENEREAL DISEASE HOSPITAL.

Concurrently with the remodeling of the first two farm houses, plans had been developing for the venereal disease hospital. As early as February 6, 1918, a special committee of the State Council of Defence had urged upon the board of directors the establishment of a temporary detention home for the treatment of venereal disease. As the site for the Connecticut State Farm for Women had not yet been selected and as our appropriation could not legally be diverted to so specific a use definite action had to be postponed until special funds could be secured. On May 2, 1918, following the purchase of the site, Dr. John

T. Black, Health Commissioner of the State, met with the board and again urged our cooperation with the federal and state authorities in giving care and custody to diseased women arrested about the army camps and naval bases. Together with representatives of the State Council of Defence the directors appeared before the Board of Control and asked for an appropriation of $20,000 with which to meet this war emergency. After personally inspecting the land and buildings of the State Farm for Women, on June 25, 1918, the Board of Control voted to increase our original appropriation by this amount on certain conditions, among other, that the federal authorities share in the running expenses. On account of the difficulty in securing contractors to undertake the work of remodeling the necessary buildings for the purpose, the opening of this department has been unavoidably delayed until the present time. The third farm house is now ready for the staff, a resident physician who will act temporarily as the superintendent, a graduate head nurse and a night assistant with three of the honor women who will be promoted from the other cottages to do the house work. The smaller of the two barns near the staff house has been remodeled and furnished and is now ready to accommodate twelve to fifteen women. Plans for the rebuilding of the larger barn are also well under way. These plans have been approved not only by the Board of Health but by Mrs. Hodder and the resident physician at the Massachusetts Reformatory for Women and Mrs. Falconer, head of the section on Reformatories and Detention Houses under the United States government. The capacity of these two buildings will be between thirty and forty.

So far it has been impossible to receive either pregnant women or mothers accompanied by a child under one year of age, on account of lack of proper provision for them. Later it may be possible to use the smaller of these hospitals as a children's building.

INSTITUTIONAL ROUTINE.

In the confusion natural and unavoidable in the establishment of a new institution where the exigencies of the moment necessarily take first place, it has been difficult to establish a definite or satisfactory routine. On arrival each woman, after being examined and bathed by the matron in charge, has been put into the institutional clothing, a simple blue and white gingham house dress. During July, all of the women then in residence were given a general physical examination by a visiting woman physician. On August 2, 1918, through the cooperation of the superintendent of the Norwich State Hospital for the Insane, arrangements were made by which one of his two resident women physicians visited the farm once a week regularly and on special call. Since this date, specimens have been sent regularly to the State Board of Health for examination for gonorrhea and syphilis. Arrangements are being made for the examination in the near future of the eyes and the teeth of the inmates.

After the physical examination, if her health has permitted, each woman has been assigned to her part in the work of her group in either the junior or senior cottage. This work has been of two general kinds, either in-door or out-door. Out doors the women have carried water, chopped wood, mowed the yards, cared for the roads and paths, weeded, dug potatoes, gathered and prepared vegetables, picked and canned blueberries, cared for the pigs and last, but not least, cut ten acres of ensilage, helped in loading it onto the carts, assisted in feeding the cutter, tramped it in the silo and now are planning to husk three hundred bushels of field corn. In doors, they have done all of the cooking, cleaning and washing for themselves and for the officers. At the same time they have been tearing the old paper from the walls of the three farm houses, and scrubbed the floor and woodwork in preparation for the painters. They have also made the sheets, pillow cases and curtains for these houses and the two hospitals. For the two months and a half since the institution was opened the life of the women has been frank-

ly very largely materialistic. Books have been obtained from the State Board of Education and the local libraries but no regular academic work has yet been established. This will begin as soon as the fall out door work is over and a trained leader is needed, but clamming, wading, bathing and tramping parties have taken place from time to time during the summer. Self-government, which has been so successfully tried in several other institutions for delinquent women, has not been officially instituted as yet but two or three house meetings have demonstrated the ability of a number of our women to think wisely for themselves in matters of discipline.

RESULTS.

The establishment of an ideal educational and vocational system has been retarded for several reasons, the lack of adequate funds, the difficulty in securing officers of previous training in modern correctional institutions for delinquent women, especially those experienced in out door life, the dormitory system and only two cottages for the classification of the inmates by age only. And yet, in spite of all these handicaps, the ten weeks' experiment with this small group of women has given your board the vision of what we may be able to do for these and for hundreds of their kind in the state of Connecticut. On the purely negative side the State Farm has taken from their respective communities twenty-nine troublesome, diseased and defective women who have for years been clogging the courts and filling the jails. Given proper support we could free every community in the state of such undesirable members. But the real proof of the worth of the experiment is to be found in the positive results on these women themselves, physically, mentally and morally. Ten weeks is a short time in which to change a life or to formulate generalizations yet in that short time the free open air life tells its own tale in increased flesh, color and animation. But the more important gain is the sign of a slowly changing point of view as it appears in the faces and words and acts of a few of our women. To

claim a change for all would be both improbable and insincere for more and more we realize that these women, undisciplined, untrained, impulsive and self-centered, will need rigid and regular training for body and mind for a period of at least a year, with few exceptions. But certain reasonable results of the wholesome home life have become apparent. Their spontaneous conversation, at first all of themselves, of the past and of the jail experiences changes as the past slowly recedes and the future looms larger on their mental horizon. The practical lesson in pioneer home making has brought rich results. It has given them something to do and something to think about and at times there has been an ideal spirit of team work with common pride in themselves and their accomplishment and of loyalty to the homes which they have so truly created. At first they could not compass the idea of the indeterminate sentence, especially those who had been jail offenders. The statement that their release depended on themselves and not upon the calendar had no meaning. But they have had time to think and they are beginning to lay less blame on others, to accept more for themselves and gradually there is dawning a recognition of the relation between their efforts and their release. They have asked for books and they have expressed a desire for religious services as they have grown less sure of their own strength and more dependent on the unseen. "At first I thought everyone was my enemy when I came here, but now I am just beginning to see what the State Farm for Women is trying to do for us." And so we have gained rather than lost faith in the recuperative power of many of our women to right themselves and to assume moral responsibility when they go out into the world again. And we believe that there are hundreds of other women and young girls just starting downward in the state of Connecticut who could be likewise helped if we may be given the right and resources to minister unto them through a staff of carefully selected women of spiritual and intellectual power.

The board of directors of the Connecticut State Farm

for Women, therefore, earnestly desire this institution to be recognized as an integral part of the great state-wide movement, together with clinics and other state custodial and correctional institutions, to stamp out venereal disease among our men, women and children. And we would have the General Assembly of Connecticut and the general public whose servants we are, look to us as gathering onto our ample acreage all the diseased and delinquent women in need of medical treatments and custodial care. With such a function to perform, we appeal to the legislature of 1919 and to all succeeding sessions to give us adequate and ample support not for the sake of our own institution only, but for the sake of the welfare of its citizens present and to come.

And so, as a result of our short experiment, the board of directors of the Connecticut State Farm for Women, respectfully makes the following recommendations:

1. That we be given sufficient appropriations with which to erect, during the next two years:

(1) A receiving building for the care and observation of inmates during the first three months after their admission.

(2) A school building with adequate quarters for academic and vocational instruction including domestic science in all its branches, laundry, dressmaking, millinery, and with an assembly hall.

(3) A sufficient number of cottages for twenty-five inmates each to house 200 women and the necessary officers, these to contain single rooms and to be separated to provide desirable isolation of groups.

(4) Also to develop the farm sufficiently to provide a food supply for the inmates and the live stock of the institution.

(5) To purchase a good herd of cows and maintain a model dairy plant.

(6) To establish a small poultry plant.

(7) To maintain adequate transportation facilities between the farm and the station at East Lyme and Niantic.

(8) To employ a trained staff for the vocational work of the school and the management of the cottages.

(9) To provide adequate equipment in all departments.

Respectfully submitted,

WILLIAM B. BAILEY,
JOHN H. GOSS,
ANNE ROGERS MINOR,
EDWARD W. HAZEN,
GEORGE C. CLARK,
HELEN W. ROGERS,
VALERIA H. PARKER,

Members of the Board of Directors of the Connecticut State Farm for Women.

STATISTICAL TABLES,

July 1, 1918, to September 30, 1918.

GENERAL STATISTICAL REPORT.

Total number of women admitted July 1, 1918, to September 30, 1918		29
Transferred to Norwich State Hospital for the Insane	1	
Transferred to Norwich Jail for temporary care	1	
Runaway not returned (out of state)	1	
Number of inmates in institution September 30, 1918	26	
	—	29

COMMITMENTS BY MONTHS.

July	12	
August	15	
September	2	
	—	29

COUNTIES REPRESENTED.

Fairfield	11	
Hartford	4	
Litchfield	1	
Middlesex	0	
New London	3	
New Haven	7	
Tolland	0	
Windham	3	
	—	29

CITIES AND TOWNS REPRESENTED.

Bridgeport	8	
Hartford	2	
Meriden	1	
New Britain	2	
New Haven	5	
Norwalk	2	
Norwich	1	
Putnam	3	
Stamford	1	
Stonington	1	
Waterbury	1	
Waterford	1	
Winsted	1	
	—	29

CHARGES.

Against property:		
Theft	1	
Against society:		
Adultery	1	
Disorderly conduct	1	
Intoxication	18	
Incorrigibility	1	
In manifest danger of falling into vice	4	
Prostitution	2	
Wayward woman	1	
	—	29

MARITAL CONDITION.

Married	18	
Single	11	
	—	29

OCCUPATION AT TIME OF ARREST.

Domestic service	13	
Factory	9	
Housewife	1	
Laundry	1	
Store	2	
Waitress	3	
	—	29

AGES REPRESENTED.

16	2	
17	3	
18	2	
19	2	
22	2	
25	1	
26	1	
29	1	
34	2	
37	2	
39	3	
40	1	
41	1	
44	1	
45	2	
47	1	
49	1	
61	1	
	—	29

BIRTHPLACE.

United States		20	
Connecticut	17		
Massachusetts	2		
Vermont	1		
Canada		1	
England		2	
Ireland		2	
Germany		1	
Scotland		2	
Sweden		1	
		—	29

PARENTAGE.

American	3
Canadian	1
English	1
Irish	10
Irish-English	1
French-Canadian	3
French-American	1
Lithuanian	1

Norwegian-Swedish	1	
German	1	
German-American	1	
German-Polish	1	
Scotch	2	
Scotch-English	1	
Swedish	1	
	—	29

RELIGIOUS PREFERENCE.

Catholic	17	
Protestant	12	
	—	29

*EDUCATION BY GRADES.

Elementary Schools:		
Eighth grade	3	
Seventh grade	1	
Sixth grade	3	
Fifth grade	4	
Fourth grade	8	
Third grade	3	
Second grade	0	
First grade	2	
Not examined	5	
	—	29

*By actual Normal School tests.

INTELLIGENCE QUOTIENTS.

As determined by the Stamford Revision of the Binet-Simon Tests.

I. Q.	No.
43	1
53	1
54	1
62	1
64	1
67	2
72	1
74	1
76	1
77	1
78	1
80	2
81	1
82	2
85	1
87	1
88	1
91	1
94	1
Previously declared insane	3
Not examined	4
	29

REPORT OF TREASURER.

July 1, 1918, to September 30, 1918.

Mr. George C. Clark, Treasurer,
Connecticut State Farm for Women,
East Lyme, Connecticut.

Dear Sir:

We have made an examination of the books, accounts and records of the Connecticut State Farm for Women covering the period from April 26, 1918, to and including December 31, 1918, the results of which are presented in the following Exhibits and Schedule.

Very truly yours,

February 3, 1919. (Signed) HADFIELD & ROTHWELL.

REPORT ON CONNECTICUT STATE FARM FOR WOMEN.

EXHIBIT A.

Statement of Expenditures Chargeable to Appropriation of the Connecticut State Farm for Women, Covering the Period From April 26, 1918, to and Including December 31, 1918.

Appropriation		$70,000 00
Expenditures made by the Treasurer of the State of Connecticut chargeable to appropriation of the Connecticut State Farm for Women	$26,295 85	
Amounts transferred by the Treasurer of the State of Connecticut to Mr. George C. Clark, Treasurer of the Connecticut State Farm for Women	25,000 00	
Total Expenditures and Amounts Transferred		51,295 85
Balance of Appropriation		$18,704 15

EXPENDITURES.

Real estate		$25,423 65
Salaries		2,149 00
Food		1,028 96
Clothing and clothing material		900 17
Furnishings and household supplies		5,446 06
Heat, light and power		926 85
Ordinary repairs		2,661 57
Farm and stable		6,165 31
Grounds		980 94
Medical and general care		742 05
Office and incidental expenses		452 30
Miscellaneous		1,037 87
Building repairs		2,023 49
Total Expenditures		$49,938 22
Balance in hands of Treasurer	$1,383 40	
Less:		
Interest received and not yet remitted to State Treasurer	25 77	
		$1,357 63
Total Expenditures and Balance in hands of Treasurer, equalling amounts chargeable against appropriation		$51,295 85

EXHIBIT B.

Receipts and Expenditures of the Treasurer Covering the Period

RECEIPTS.

From April 26, 1918, to and Including December 31, 1918.

From State Treasurer:			
June 3, 1918	$5,000 00		
August 21, 1918	5,000 00		
October 2, 1918	5,000 00		
November 9, 1918	5,000 00		
December 5, 1918	5,000 00		
Total		$25,000 00	
From interest on bank deposit:			
July 6, 1918	$5 15		
August 1, 1918	4 66		
September 3, 1918	33		
September 26, 1918	8 35		
October 29, 1918	5 86		
November 27, 1918	5 81		
December 27, 1918	5 75		
Total		35 91	
Total Receipts			$25,035 91

EXPENDITURES.

Salaries	$2,149 00	
Food	1,028 96	
Clothing and clothing material	900 17	
Furnishing and household supplies	5,292 06	
Heat, light and power	926 85	
Ordinary repairs	2,661 99	
Farm and stable	5,621 99	
Grounds	980 94	
Medical and general care	742 05	
Office and incidental expenses	452 30	
Miscellaneous	862 99	
Building repairs	2,023 49	
Interest paid to State Treasurer	10 14	
Total Expenditures, per Vouchers		$23,652 51
Balance December 31, 1918		$1,383 40

FARM REPORT.

Owing to the fact that the site was not selected until the spring of 1918, and that women were not received until the middle of July, it was impossible to enter upon extensive farm operations. Acting upon the advice of experts from the Connecticut State College for Agriculture, a kitchen garden was planted which furnished the necessary vegetables for the inmates during the summer. In addition to this 300 bushels of potatoes and a considerable stock of beans were available for our use during the winter. Sixty loads of hay and 75 tons of ensilage in addition to several loads of corn-stalks were put into the barns in the autumn.

BY-LAWS.

I. OFFICERS.

Section 1. **Number.** The officers of this board shall be a president, a secretary and a treasurer.

Sec. 2. **Election.** The election of these officers shall be by ballot and shall take place at the annual meeting in July or at a special meeting called for this purpose.

Sec. 3. **Terms of Office.** The terms of these officers shall be for one year and shall date from the first of July.

Sec. 4. **Duties.** President. It shall be the duty of the president to preside at all meetings of the board; to call meetings, both regular and special, and to serve as an ex-officio member of all committees.

Secretary. It shall be the duty of the secretary to keep an accurate record of the proceedings for the board; to give written notice to each director of the time, place and special purpose of meetings; prepare such papers and conduct such correspondence as it shall direct.

Treasurer. It shall be the duty of the treasurer, under the direction of the board of directors, to take charge of its fiscal concerns. He shall keep full and accurate accounts of all receipts and expenditures and of property entrusted to him. He shall pay all bills approved by the board. Current bills are to be paid upon approval of the President and Treasurer. All accounts, with suitable vouchers, shall be submitted in writing at each quarterly meeting and a condensed statement at the annual meeting. Special statements may be called for whenever the board may so require and at all times his books shall be open to its members.

II. MEETINGS.

Section 1. **Annual.** The annual meeting of this board shall be held in July or shall be specially called.

Sec. 2. **Regular.** Regular Meetings of this board shall be held on the first Wednesday of February, May, August and November.

Sec. 3. **Special.** Special meetings may be called by the president or at the written request of any two members of the board. The secretary shall give at least three days' notice and in naming the day, date, hour and place of meeting shall also mention the purpose of calling the same.

Sec. 4. **Quorum.** Five shall constitute a quorum for the transaction of business.

III. COMMITTEES.

Committees, standing or special, shall be created by the board as need may arise. These committees shall be appointed as the board may direct and shall perform such duties as the board shall specify. All reports of committees shall be submitted in writing, signed and filed with the secretary.

IV. ORDER OF BUSINESS.

The order of business at the regular meeting shall be as follows:
Reading of the minutes of last meeting.
Report of the secretary, communications received, etc.
Report of the treasurer.
Report of the committees.
Report of the superintendent (quarterly).
Unfinished business.
New and miscellaneous business.

The order of business at the annual meeting shall be:
Reading of the minutes of the last meeting.
Annual report of the treasurer.
Annual report of the superintendent.
Election of officers—president, secretary and treasurer.
Appointment of member to prepare annual report to the governor.
Unfinished business.
New and miscellaneous business.

V. CHANGE IN BY-LAWS.

The by-laws may be changed by a majority vote at any regular quarterly meeting, notice thereof having been given in writing beforehand.

LAW ESTABLISHING THE CONNECTICUT STATE FARM FOR WOMEN.

AN ACT ESTABLISHING THE CONNECTICUT STATE FARM FOR WOMEN.

GENERAL ASSEMBLY, JANUARY SESSION, A. D. 1917.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. A state reformatory for women to be known as The Connecticut State Farm for Women is established.

Sec. 2. The Connecticut State Farm for Women shall be under the management of seven directors who shall be appointed by the governor, and at least three of whom shall be women. Within sixty days after the passage of this act the governor shall appoint one director for one year, one for two years, one for three years, one for four years, one for five years, one for six years and one for seven years; from the first day of the next month after their appointment, and annually thereafter the governor shall appoint one director for seven years. He shall also fill by appointment any vacancies that may occur for the unexpired term or terms thereof. All such appointments shall be of a non-partisan character. The governor shall have power to remove any of said directors for cause. The directors shall receive no compensation for their services, but shall be paid their necessary expenses incurred while engaged in the performance of their official duties. There shall be at all times a representation of at least three women upon said board of directors.

Sec. 3. The directors are authorized to purchase in the name of the state as a site for said farm, not less than two hundred acres of suitable land. Such land shall include woodland and tillable pasture, with a natural water supply, and be located reasonably near a railroad. The board of directors is authorized to use if practicable, for the purpose of said institution, any site already in use by this state.

Sec. 4. The directors shall cause to be prepared plans and specifications for remodelling or erecting on such site necessary buildings for a suitable plant for the institution, which plans shall provide for cottages to be arranged for the proper classification of inmates, as to the character and needs of such inmates. The directors shall furnish and equip the same ready for use. Contracts shall be made by the directors and those calling for an expenditure of over five hundred dollars shall be duly advertised and competitive bids received thereon. In connection with the remodelling or erection of the various cottages and buildings comprising the plant of the institution, no building permit shall be required from the municipal corporation in which the institution may be located. When such buildings have been prepared and equipped, and the necessary staff of officers been organized, the directors shall so certify to the governor, who thereupon shall issue a public proclamation that the institution is ready for the reception of inmates.

Sec. 5. The sum of fifty thousand dollars is appropriated for the purchase of a site for the institution and for the preparation of the buildings necessary to start the institution and to make it ready for the reception of inmates and for the payment of salaries and running expenses for the two fiscal years after the passage of this act.

Sec. 6. The directors shall have control of the institution; determine the policy of the same and make necessary rules for the discipline, instruction and labor of inmates; form a board of parole and discharge; cause to be kept proper records, including those of inmates; fix the salaries of the officers of said institution; appoint from their own number a president and a secretary who shall hold office for such length of time as the board may determine; hold meetings at least quarterly at said institution and audit the accounts of the superintendent quarterly. They shall report annually to the governor the general and financial condition of said institution, with such recommendations as they may desire to make, a copy of which report shall be sent to the secretary of each state.

Sec. 7. The directors shall appoint and remove at discretion, a superintendent of said institution who shall be a woman, not of their number, and who, before entering upon the duties of her office, shall give a bond to the state, with sufficient surety in the sum of five thousand dollars, and shall be sworn to a faithful performance of her duties. The superintendent shall receive such compensation as shall be fixed by the directors and shall reside at said institution.

Sec. 8. The superintendent shall manage said institution and have control over the inmates thereof, and shall make rules and regulations for the administration of said institution, subject to the approval of the board of directors. The superintendent shall, also, subject to the approval of the board of directors, determine the number, select, appoint and assign duties of all subordinate officers of said institution, who shall be women, as far as practicable, and shall be sworn to a faithful performance of their duties. There shall be a deputy superintendent and, as soon as the size of the institution demands it, a resident physician and a clerk. The superintendent may remove any officer appointed by her. The clerk of the institution shall give a bond to the state with sufficient surety in the sum of five thousand dollars.

Sec. 9. Women over sixteen years of age belonging to any of the following classes may be committed by any court of criminal jurisdiction to said institution; first, persons convicted of, or who plead guilty to the commission of felonies; second, persons convicted of, or who plead guilty to the commission of misdemeanors, including prostitution, intoxication, drug-using, disorderly conduct; third, unmarried girls between the ages of sixteen and twenty-one years who are in manifest danger of falling into habits of vice or who are leading vicious lives, and who may be convicted thereof in accordance with the provisions of chapter 233 of the public acts of 1905 as amended by chapter 48 of the public acts of 1907. Only such offenders, however, may be committed to said institution, as in the opinion of the trial court, will be benefited physically, mentally or morally by such commitment, and immediately upon commitment a careful physical and mental examination, by a competent physician, shall be made of the person committed. The court imposing a sentence on offenders of either class shall not fix the term of such commitment. Commitment to said institution shall be made within one week after sentence is imposed, by the sheriff when sentenced by the superior court, and by a police officer when sentence is imposed by any city, town or borough court, but no offender shall be committed to such institution without being accompanied by a woman in addition to the officer. The expenses of such commitment shall be paid the same as commitments to other penal institutions in the state. The trial court shall cause a record of the case to be sent with the commitment papers on blanks furnished by the institution. The duration of such commitment, including the time spent on parole,

shall not exceed three years, except where the maximum term specified by law for the crime for which the offender was sentenced shall exceed that period, in which event such maximum term shall be the limit of detention under the provisions of this act, and in such cases it shall be the duty of the trial court to specify the maximum term for which the offender may be held under such commitment.

Sec. 10. Said board of directors shall constitute a board of parole and discharge. Any inmate of the institution who has been in confinement within said institution, may, upon recommendation of the superintendent, be allowed to go on parole in the discretion of a majority of said board of parole under the following conditions: That she is in good physical condition, has ability to earn an honest living, has a satisfactory institutional record, based on the merit system and a proper home to which she may go, or that suitable employment has been secured in advance by the board of parole. Each person paroled or discharged from said institution shall be given, if the superintendent deems it best, suitable clothing, transportation expenses and not more than five dollars. Authority is conferred on said board of parole to establish such rules and regulations as it may deem necessary, setting forth the conditions upon which inmates may be discharged upon parole, and to enforce such rules and regulations and provide suitable supervision by agents of the institution.

Sec. 11. While upon parole, each inmate of said institution shall remain in the legal custody and under the control of the board of directors, and subject at any time to be taken back to said institution for any reason that shall seem sufficient to said board. Whenever any paroled inmate of said institution shall violate her parole and be returned to the institution, she may be required to serve the unexpired term of her maximum sentence including the time she was out on parole or any part thereof in the discretion of the board of directors, or she may be paroled again if the said board of parole so decide. The request of said board of directors, or any person authorized by the rules of said board, shall be sufficient warrant to authorize any officer of said institution or any officer authorized by law to serve criminal process within this state, to return any inmate on parole into actual custody; and it shall be the duty of police officers, constables and sheriffs to arrest and hold any parole inmate when so requested, without any written warrant, and, for the performance of such duty, the officer performing the same, except officers of said institution, shall be paid by the board of directors of said institution out of the institution funds such reasonable compensation as is provided by law for similar services in other cases.

Sec. 12. If any inmate shall escape from said institution or from any keeper or officer having her in charge or from her place of work while engaged in working outside the walls of said institution, she shall be returned to said institution when arrested, and may be disciplined in such manner as the board of directors may determine. All the provisions of section eleven relating to the arrest and return of paroled inmates shall apply to the arrest and return of escaped inmates.

Sec. 13. The board of directors may transfer to the state prison, or to the jail of the county from which she was sentenced, any inmate of said institution who shall appear to said board to be incorrigible, or whose presence in said institution may be seriously detrimental to its well-being, provided such inmate might have been originally so committed, subject to be returned upon requisition of the board of directors. The directors may transfer to any other

appropriate state institution, any inmate whose welfare the board, after proper study and examination of her case, shall decide may be best cared for at such other institution. Whenever any inmate of said institution shall be, in the judgment of the board of directors, in need of special medical attention, such inmate may be transferred to a hospital or other appropriate state institution, subject to return upon requisition of the board of directors. The board of directors may transfer to the Connecticut hospital for the insane any inmate of said institution who may be insane, but no inmate of said institution shall be transferred except upon the written certificate of two competent physicians not connected with the institution to the effect that such inmate has become insane, and any inmate declared to be insane shall have a right of appeal to the superior court for the county in which said institution is located from said order of transfer. Upon the written certification of the superintendent of the Connecticut hospital for the insane that an inmate transferred has become cured of her insanity, the directors shall, by requisition, require the return of such inmate to said institution.

Sec. 14. If it shall appear to said board of directors, acting as a board of parole and discharge, that any inmate on parole, although not having yet reached her maximum term, has maintained a satisfactory parole record, and will continue to lead an orderly life if discharged, said board, by unanimous vote of all the members present at any stated meeting thereof, may discharge such inmate from said institution.

Sec. 15. If any woman committed to said institution is, at the time of her commitment, the mother of a child under one year of age, such woman may retain such child in said institution until it attains the age of two years, when it must be removed therefrom. The board of directors may cause such child to be placed in an asylum for the children in this state and pay for the care and maintenance of such child therein at the rate fixed by law until the mother of such child shall be discharged, or may commit such child to the care and custody of some relative or proper person willing to assume such care and pay for such child at the same rate if deemed necessary. Any child of a woman committed to said institution who is over one year of age at the time of its mother's commitment, and which might otherwise be left without proper care or guardianship, shall be committed by the trial court, upon the same terms as to payment as herein provided, to each asylum for children as may be provided by law in this state for such purpose, or to the care and custody of some relative or proper person willing to assume such care. If a child shall be born to any woman while an inmate of said institution, such child may be retained in said institution until it shall be two years of age, when it must be removed therefrom. The board of directors may cause such child to be placed in an asylum for children in this state and pay for the care and maintenance of such child therein at the rate fixed by law until the mother of such child shall have been discharged, or may commit such child to the care and custody of some relative or proper person willing to assume such care, and pay for such child at the same rate if deemed necessary.

Sec. 16. The state board of charities shall have, with reference to said institution, the same authority that is conferred upon said board by sections 2858 and 2862 of the general statutes with reference to the state prison as amended by chapter 94 of the public acts of 1913.

Sec. 17. The bodies of inmates who die in said institution may, if unclaimed for a period of twenty-four hours, be at the disposal of the professors of anatomy and surgery in the medical school of Yale

University, to be used for the purpose of advancing medical science in this state, and shall be subject to their order.

Sec. 18. The board of directors in making rules and regulations for the government of said institution, shall make provision for a system of general and vocational instruction, including useful trades and domestic science, and for proper recreation facilities.

Sec. 19. This act shall take effect from its passage, except such provisions as provide for the commitment, custody and treatment of inmates which shall take effect upon the issuance of the proclamation by the governor as provided in section four.